BEAMS™
System Software
User Guide

Rev. 2.0, December 5, 2000

Hypervision Incorporated
46560 Fremont Blvd.
Suite 415
Fremont, CA 94538 USA

Phone: 510-651-7768
Fax: 510-651-1415

www.hypervisioninc.com

Hypervision, Inc.
Manual Update Revision 0.1
Pages 39 - 44 March 2001

Contents

Introduction

Welcome to Hypervision™ BEAMS™ (Backside Emission Analysis Microscopy System) System Software — the industry-standard emission analysis software that provides a single platform for operating Hypervision's entire line of emission microscopes. Whether you are operating a stationary, lab-based BEAMS™ system, or the portable test floor PTF1™ system, BEAMS System Software provides you with a single, user-friendly interface tailored to the specific Hypervision system you are operating.

BEAMS System Software gives you the tools to easily acquire, enhance, compare, print and archive both emission and illuminated images. You control microscope magnification levels using BEAMS System Software to select turret lenses of the BEAMS, and to operate the motorized zoom optics of the PTF1. BEAMS System Software provides contrast and illumination controls during and after image acquisition, and a digital zoom function for acquired images. To compare functional and defective parts, BEAMS System Software gives you tools to align, overlay and subtract acquired images, including alignment controls that compensate for X/Y, and theta rotation variations between images, as well as filters for spatial edge sharpening and enhancement.

About this manual

The *BEAMS System Software User Guide* provides detailed information about the BEAMS System Software functions and controls. It is designed to help you quickly learn the use of BEAMS System Software to operate your Hypervision emission microscope system.

The information contained in this manual is based on the assumption that you have a working knowledge of the Microsoft® Windows NT® 4.0 or Windows 98® operating systems. For help with questions about basic system functions, please refer to the Windows documentation included in the BEAMS System Software package.

BEAMS System Software documentation

The BEAMS System Software package includes the following printed and online documentation:

User Guide Contains complete information on all features and functions of the BEAMS System Software.

Help Menu Contains all of the information available in the user guide, condensed and optimized for online use.

Quick Reference Card A convenient summary of BEAMS System Software functions and procedures.

Windows Documentation Microsoft Windows NT or Windows 98 operating system documentation.

BEAMS System Software computer hardware

BEAMS System Software is preinstalled on an industrial standard rack mountable PC with an Intel Celeron or Pentium III processor, based on your Hypervision system requirements, and typically includes a 24-bit video display card, and a 20" VGA monitor. The computer platform is customized to meet individual requirements.

Hypervision Technical Support

For technical support on problems not covered by the provided documentation,. you may contact Hypervision Technical Support directly at 510-651-7768, extension 25 or 20.

Starting BEAMS System Software

NOTE: Please refer to the operation manual included with your Hypervision emission microscope system for instructions on the microscope and probestation start-up procedures specific to your system.

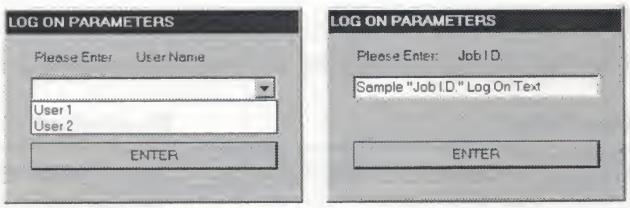
1 Turn on the computer.

2 When the Windows NT/98 desktop has finished loading, you will see the standard Windows system icons on the left side of the screen. In the customized task bar at the bottom of the screen is the shortcut icon for the BEAMS System Software.

BEAMS System Software icon

3 To start the BEAMS System Software, click the BEAMS icon, or click the Start button located on the left side of the task bar, and select Programs > BEAMS > BEAMS from the Start menu.

4 In the LOG ON PARAMETERS dialog, your options are:

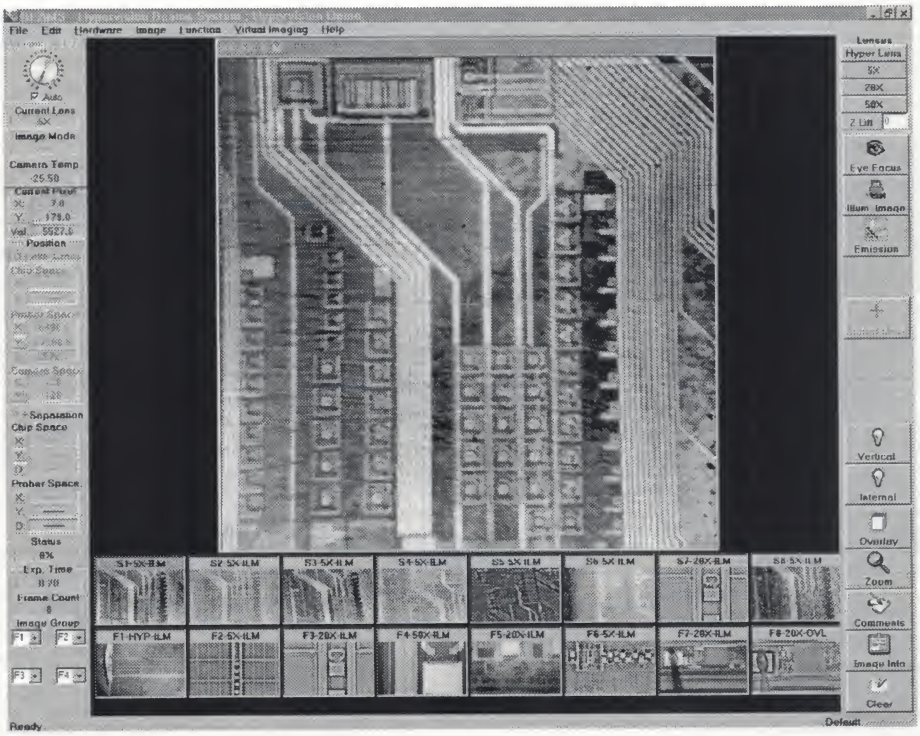


- Type a new user name, or select an existing user name by clicking the menu button to the right of the field (see pages 9 and 45), or
- Click Enter to begin your session in the default mode.

When the Enter request changes to Job I.D., you can:

- Enter a text description or a numeric identification that will be tagged to each image file along with the data displayed in the image information window (see page 21), or
- Click Enter to begin your session in the default mode with no image information identification.

5 When the BEAMS System Software workspace appears, you are ready to begin your work session.



Conventions

This manual uses the following conventions for menus, keyboard, and mouse operations.

Convention	Description
Hardware > Calibration > ParCenter	Select Parcenter from the Calibration submenu of the Hardware menu.
Alt + appropriate arrow key Ctrl + appropriate arrow key	Hold down the Alt or Ctrl key and press the arrow key that corresponds to the direction you want to move a cross hair cursor or selection marquee.
Click-drag	Click the left mouse button, and with the mouse button held down, drag the cursor to define a rectangular selection area, or marquee.
Click	Click the left mouse button. • Clicking within an image area produces a red cross hair that is overlaid on the image as a location marker. • To delete the cross hair marker, position your cursor over it and click-drag it a short distance.
Double-click	Click the left mouse button twice.
Right-click	Click the right mouse button. • Right-clicking within an image area produces a green cross hair that is overlaid on the image as a location marker. • To delete the cross hair marker, position your cursor over it and click-drag it a short distance.
Drag and drop	Right-click on an image to select it, and with the mouse button held down, drag the cursor to another location, for example, a pane in the fixed image stack.

Glossary

This manual uses the following terminology that is specific to use of the BEAMS System Software.

Term	Definition
Region of interest (ROI)	A user-definable area of an image within a rectangular red selection marquee, set by default to encompass the entire image area during illuminated image acquisition, and also by default, 50% of the image area during emission image acquisition. The ROI is used by the BEAMS System Software to calculate focusing and contrast data.
Device under test (DUT)	A chip or wafer to be examined.
Probestation	The probestation encompasses the platen, chuck and programmable microscope movement (PMM), as well as probestation software. Probestations are third party-manufactured components with a range of features and functionality that are installed according to each customer's specifications in the Hypervision emission microscope system.
Chuck	The platform of the probestation beneath the optic tube upon which a device is positioned.
Enclosure	The light-tight cabinet containing the probestation.
Illuminated image	An image of a device obtained with vertical illumination showing architectural detail.
Emission image	An image obtained from a biased device showing only photon emissions.
Overlay image	A composite image obtained by superimposing illumination and emission images of a device so that the emission sites can be located in reference to architectural detail.

Term	Definition
Saved image	In general usage, a saved image refers to any image in either of the buffer memory image stacks.
Saved image file	Images saved with the File > Save command as external files can only be accessed using the File > Open command, and unless specifically referred to, are not included in the category of saved images as pertains to the BEAMS System Software workflow.

Chapter 1: BEAMS System Software Workspace

Workspace overview

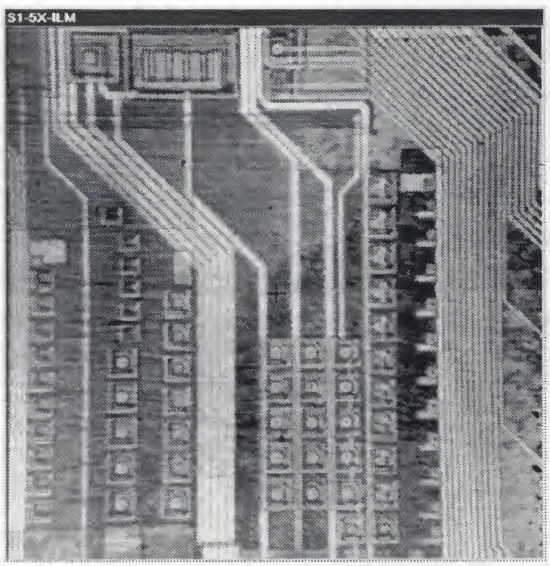
The BEAMS System Software workspace includes the standard Windows title bar at the top of your screen containing the basic commands menu icon, application and owner information, and the minimize, maximize, and close control buttons.Below the title bar is the BEAMS System Software menu bar.

Title and menu bars

Indicator panel

Control panel

On the left side of the workspace is the indicator panel containing fields for the display of operational values, coordinates, and status. On the right side is the control panel containing command buttons that provide shortcuts for controlling microscope and software functions.



Active image window

Centered in the workspace is the image display area, which contains the images you will acquire, save and process during your work session, The active image window displays either the most recent image sampled by the microscope, or an existing image selected by the user. Image groups selected by the user are displayed in a matrix of individual, 1/4 sized windows in the display area.

At the bottom of the image display area is the first-in, first-out (FIFO) buffer memory image stacks panel, a display matrix containing two rows of eight panes each. The top row of panes, numbered S1 – S8, is the scratch image stack which contains acquired or existing thumbnail images displayed in the order of their occupation of the active image window. The scratch stack images are shuttled

from the S1 to the S8 panes as successive images are displayed in both the active image window and as a thumbnail in the S1 pane. If an image is not saved, it is overwritten after displaying in the S8 pane.

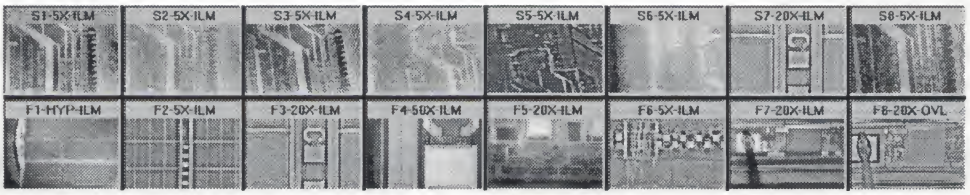


Image stacks panel

The bottom row of panes, numbered F1– F8, is the fixed image stack, displaying images that have been saved from scratch memory by right-click dragging the image to a pane in the fixed image stack.

NOTE: *Images saved to the fixed image stack are only saved in the fixed image FIFO buffer memory. When an image from the scratch image stack is dragged to a pane in the fixed image stack, the image occupying that pane is overwritten in the buffer memory. To save both scratch and fixed images permanently, you must use the Save command (see pages 9 and 45).*

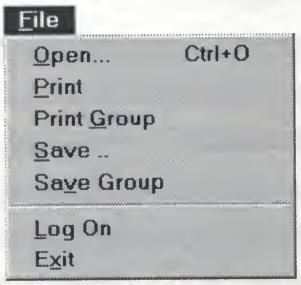
The standard Windows status bar is at the bottom of the workspace. A description of the operation in progress is displayed on the left side, and the current user name is displayed on the right side.

Status bar

Menu bar commands

The menu bar commands include standard operating system commands in addition to the specialized BEAMS System Software commands. The most commonly used commands are also accessible by clicking buttons in the control panel. Commands displayed in gray indicate unavailable functions due to equipment or file status.

File



Open Opens an existing image file to the S1 image stack pane.

Print Prints the image displayed in the active image window, automatically scaled to fit an 8.5" x 11" page (see page 46).

Print Group Prints the image group designated in the image group selector (see page 17), scaled to fit an 8.5" x 11" page (see page 47).

Save Saves the image displayed in the active image window to a directory on your internal hard drive, a networked hard drive, or on removable media (see page 45).

Save Group Saves the image group designated in the image group selector (see page 17) to a directory on your internal hard drive, a networked hard drive, or on removable media, as a single file with each image displayed in a separate quadrant (see page 46).

Log On Allows you to log on using a different user name or different job ID information (see page 3).

Exit Quits BEAMS System Software to end your work session.

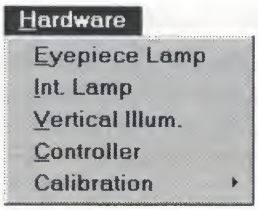
Edit

Copy Clipboard Copies the active image or a single selected image of a displayed image group to the Windows clipboard.

Arrows and Comments Using the Arrows and Comments dialog, you can add editable left, right, up and down oriented arrow overlays as location markers, and an editable text block overlay to the active image window.

- ***SHORTCUT:*** *Click the* ***Comments*** *button on the control panel (see page 20).*

Hardware



Provides selections for microscope illuminator lamps, camera system setup, and system calibration.

Eyepiece Lamp Actives green filtered vertical illumination for direct observation through the binocular eyepiece, and as an aid to positioning the DUT.

- ***SHORTCUT:*** *Click the* ***Eye Focus*** *button on the control panel (see page 18).*

Int. Lamp Activates the ambient enclosure illumination lamp.

- ***SHORTCUT:*** *Click the* ***Internal*** *button on the control panel (see page 19).*

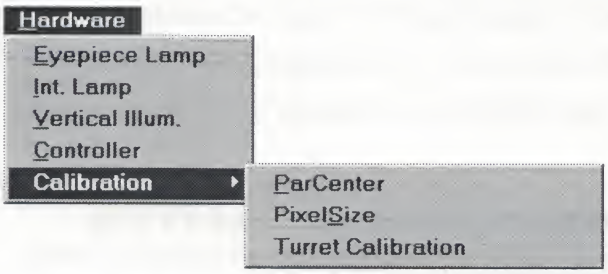
Vertical Illumination Actives vertical illumination.

- ***SHORTCUT:*** *Click the* ***Vertical*** *button on the control panel (see page 19).*

Controller Displays camera hardware settings.

NOTE: *These settings are factory configured to interface the BEAMS System Software with the specific camera installed on your microscope. Do not change these settings, except with direct Hypervision supervision for the installation of a replacement camera.*

Calibration



ParCenter Calibrates the field of view centers of the microscope lenses to a common point.

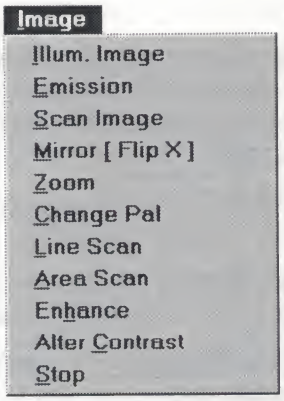
PixelSize Creates compensation tables that establish correct linearity between each lens and the probestation platform movement.The Parcenter calibration must be preceded by the PixelSize calibration.

NOTE: *In order to calibrate the microscope successfully, each lens must seat securely into its mechanical detent as it moves into position. In addition, the Pixel Size calibration must be accurate before performing any other calibration procedure.*

Turret Calibration Displays turret overdrive settings that are calibrated to center each lens under the optic tube of the microscope following rotation of the turret.

NOTE: *These settings are factory configured to interface the BEAMS System Software with the specific turret hardware installed on your microscope. Do not change these settings, except with direct Hypervision supervision.*

Image



Illum. Image Activates process of acquiring an illuminated image.

- ***SHORTCUT:*** *Click the **Illum. Image** button on the control panel (see pages 18 and 23).*

Emission Activates process of acquiring an emission image.

- ***SHORTCUT:*** *Click the **Emission** button on the control panel (see pages 18 and 25).*

Scan Image Allows you to acquire a tiled, composite image of a device that is larger than the field of view of any given lens, by programming the probestation to move the device beneath the lens relative to four corner locations you designate as reference points. These reference points are used by the BEAMS System Software to precisely map multiple images of the device into a single integrated file. (see page 27).

Mirror [Flip X] Flips selected image on horizontal (X) axis.

Zoom Digitally magnifies view of saved image.

- ***SHORTCUT:*** *Click the **Zoom** button on the control panel (see page 20).*

Change Pal Toggles display of emission pixels between red and multi-color palettes on a saved emission image.

Line Scan Displays a line histogram on a saved image corresponding to the selected X- or Y-axis pixels (see page 37)

Area Scan Displays an area histogram on a saved image corresponding to a selected X/Y area of pixels, and allows you to customize a three dimensional view of the histogram (see page 38).

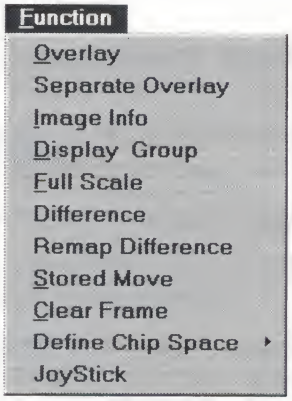
Enhance Displays the Image Enhancement dialog which provides sharpen, edge, smooth and blur filters, and kernel size options, to optimize saved images (see page 31).

Alter Contrast Provides contrast and brightness controls to process saved illuminated images, and additionally, for saved emission images provides an emission threshold control (see page 32).

Stop Terminates image acquisition.

- ***SHORTCUT:*** *Click the **Stop** button on the control panel (see page 18).*

Function



Overlay Merges saved illuminated and emission images with shared coordinates into a composite image, allowing correlation of chip surface or subsurface architecture to emission data.

- ***SHORTCUT:*** *Click the **Overlay** button on the control panel (see pages 19 and 33).*

Separate Overlay Restores the original component images of an overlay composite image to buffer memory.

Image Info Displays the Image Information window which provides background file data of a selected image.

- ***SHORTCUT:*** *Click the **Image Info** button on the control panel (see page 21).*

Display Group Displays the image group designated with the Image Group menus in the indicator panel as an active image window matrix.

Full Scale Expands the region of interest (ROI) area marquee to the default full image size during image acquisition, and when applying the Alter Contrast and Enhance Image commands to a saved image (see page 23).

- ***SHORTCUT:*** *Click the **Full Scale** button on the control panel (see page 19).*

Difference Subtracts the luminance of normally saturated transistors of a device image captured in a static, nonfailure state from a subsequently captured emission image of the device in a failing state (see page 34).

NOTE: *The difference command can only be applied to corresponding images of a device that has not been moved, because the difference command algorithm functions by comparing luminance levels on a pixel-by-pixel basis of two otherwise identical images.*

Remap Difference Allows you establish coordinate points on an acquired image of another device of the same type, so that the difference command can be applied using the newly acquired image (see page 34).

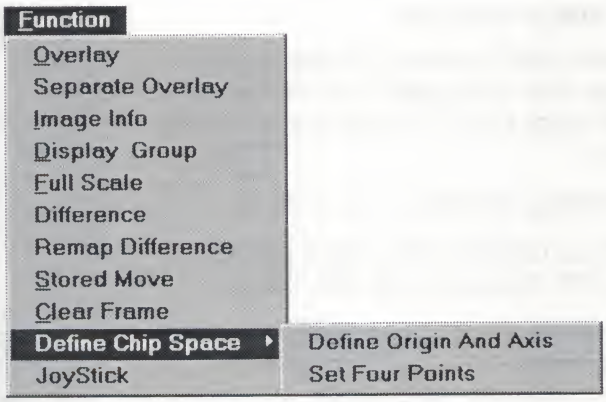
Stored Move Positions microscope field of view center to previously designated location.

- ***SHORTCUT:*** *Click the **Stored Move** button on the control panel (see page 19).*

Clear Frame Clears active image and image group windows from the image viewing area.

- ***SHORTCUT:*** *Click the **Clear** button on the control panel (see page 21).*

Define Chip Space Provides controls for mapping acquired images of devices to their corresponding CAD engineering drawings (see page 39).



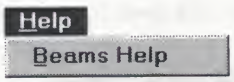
Define Origin and Axis Provides controls to set the axis orientation of the CAD drawing, theta correction value, and chip/CAD scaling factor (see page 39).

Set Four Points Provides controls to establish the numeric correlation of the image to the CAD drawing (see page 42).

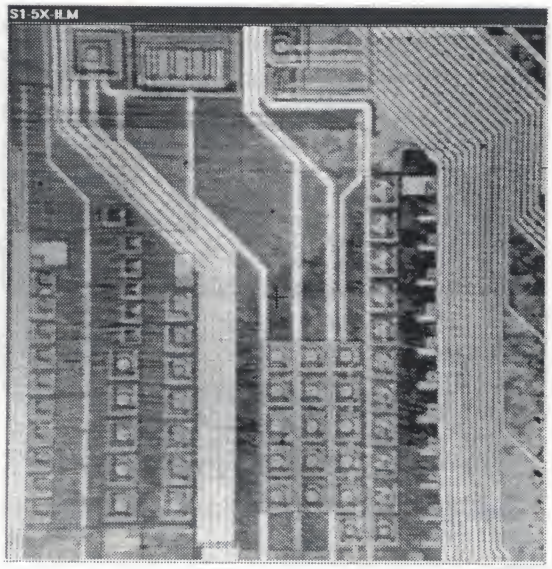
Joystick Activates the Joystick control palette (see page 21).

Help

BEAMS Help BEAMS System Software online help system.



Active image window



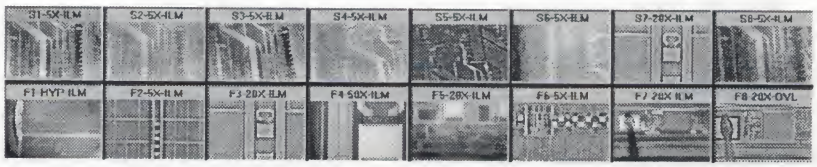
A file name is automatically generated for every new image. This is displayed in the header bar above the image area, and contains the following information:

- Buffer memory address: S1–S8 or F1–F8.
- Microscope objective lens used to acquire the image: HYP (Hyperlens), 5X, 20X, 50X.
- Type of image: EM (emission), ILM (illuminated), OVL (overlay).

Active image windows display at full or 1/4 size.

- To expand a 1/4 size image to full size, double-click anywhere within the image area.
- To reduce a full size image to 1/4 size, double-click anywhere within the image area.

Image stacks panel



Scratch and fixed images displayed in the image stacks panel are written to buffer memory directories created on your hard drive by the BEAMS System Software. When you begin a work session using an established user name, the BEAMS System Software opens displaying the same images in the active image window and the image stacks panel as when you were last working.

- To save a scratch image to the fixed image stack, right-click anywhere within the image area, and drag it to any fixed image (F) pane.
- To expand a scratch or fixed thumbnail image to an active image window, double-click anywhere within the image area.

Indicator panel displays

Headings for the Position coordinate displays are interactively color-coded to reflect a mouse-clicked cross hair location marker, or by default, the center of the displayed image.

- Red headings indicate po sition and coordinates referenced to a left-clicked location marker.
- Green headings indic ate position and coordinates referenced to a right-clicked location marker.
- Blue headings indicate default state with no active image, or coordinates referenced to the exact center of an active image with no location marker.

Lamp Dial

The lamp dial is a context-sensitive level indicator and control for vertical and internal illumination.

Eye Piece Lamp To override the default illumination level, click on the dial circumference.

Vertical Lamp To override the default illumination level, deselect Auto, and click on the dial circumference.

- Click the Auto checkbox to select or deselect automatic adjustment of the illumination level.

Internal Lamp To override the default illumination level, click on the dial circumference.

Current Lens

Displays lens currently engaged in optic path of microscope.

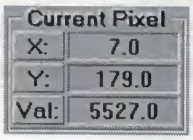
Image Mode

Displays image acquisition mode.

Camera Temp.

Displays camera temperature.

Current Pixel



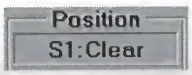
X/Y values are in the context of the pixel layout grid of the camera's CCD (0/0 = upper left corner).

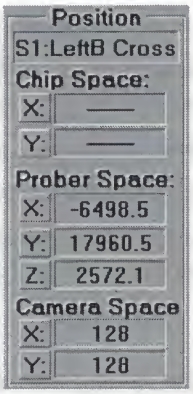
X: Displays X-axis position of pixel at location of cursor.

Y:Displays Y-axis position of pixel at location of cursor.

Val: Displays luminosity value of pixel at location of cursor.

Position





Displays buffer memory address of current image (S1-S8), and current cross hair identification according to the originating left or right mouse button click, or none (clear).

Chip Space

X/Y values are in the context of a metric grid corr esponding to a user-defined correlation between the camera space pixel grid and the prober space metric grid (see page 39).

- X: Displays X-axis chip space position of cross hair in microns.
- Y: Displays Y-axis chip space position of cross hair in microns.

Prober Space

X/Y values are in the context of a metric grid corresponding to the probestation range of motion (0/0 = center of range of motion).

- X: Displays X-axis probestation position of cross hair in microns.
- Y: Displays Y-axis probestation position of cross hair in microns.
- Z: Displays Z-axis probestation position of cross hair in microns.

Camera Space

X/Y values are in the context of the pixel layout grid of the camera's CCD (0/0 = upper left corner).

- X: Displays X-axis position of cross hair in pixels.
- Y: Displays Y-axis position of cross hair in pixels.

Separation

Displays distance between left- and right-clicked cross hair location markers. X/Y values are for the current (most recently placed) cross hair.

Chip Space

- X: Displays X-axis position of cross hair in pre-defined chip space.
- Y: Displays Y-axis position of cross hair in pre-defined chip space.
- D: Displays distance between cross hairs in pre-defined chip space.

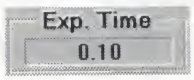
Prober Space

- X: Displays X-axis position of cross hair in microns.
- Y: Displays Y-axis position of cross hair in microns.
- D: Displays distance between cross hairs in microns.

Status

Displays progress bar and completion percentage of the exposure time of the image being acquired.

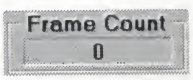
Exposure Time



Displays camera exposure time per image, selected using the illuminated image acquisition Focus Setup dialog, or the Emission Image Acquisition dialog (see pages 23 and 25).

- In the Focus Setup dialog, under Focus Mode, Focus is selected by default, with an exposure time of 0.1 second per image, giving you a near real time display of the images being sequentially acquired, which is useful while you are in the process of focusing and centering the device in the image area image.
- Selecting HiRes under Focus Mode produces an exposure time of 0.9 seconds per image, which results in a display time lag while you are in the process of focusing and centering the device in the image area image.
- Regardless of which illuminated image acquisition focus mode you select, the default exposure time of the final image of the sequence is 0.9 seconds.
- The exposure time selected in the Emission Image Acquisition dialog is also used for the final image of the sequence.

Frame Count



Displays number of frames acquired during acquisition sequence.

Image Group

The image group selector allows you to select four fixed images as an image group, to save as a single composite file or to print (see pages 46 and 47).

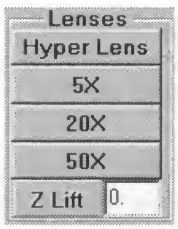
- Frame numbers in each of the four fields indicate a designated image.
- Click the downward pointing arrows to select from drop-down menus of available images, or click in a field to select the text and type a frame number not displayed.
- Press Tab to select sucessive fields.

Control panel button commands

Headings for applicable individual command button titles are interactively color-coded, in conjunction with the relevant values in the indicator panel displays, to reflect the active mouse-clicked cross hair insertion point.

- A left-clicked cross hair and applicable individual command button titles are colored red.
- A right-clicked cross hair and applicable individual command button titles are colored green.
- The above command button titles are colored blue if there is no cross hair insertion point.

Lenses



Selections activate rotation of motorized turret to the selected lens.

- Blue letters indicate the selected lens.

Hyper Lens Wide angle lens

5X Low level magnification

20X Medium level magnification

50X High level magnification

Z Lift The amount, in millimeters, of the Z-axis lift of the optic assembly, prior to turret rotation during lens selection change, that provides clearance between the lenses and probes attached to the DUT.

- The amount of Z lift entered in this window will apply to subsequent lens changes.

Eye Focus

Activates binocular eyepiece and vertical lamp with green filter for direct observation and positioning of device.

- Blue letters indicate that the eyepiece and lamp are activated.

Illum. Image

Activates illuminated image acquisition process (see page 23).

Emission

Activates emission image acquisition process (see page 25).

Stop

Ends image acquisition sequencing.

Live Move/Stored Move

Centers the field of view of subsequently acquired images to a position designated in an active image.

To recenter image on a new location during image acquisition:

1 Position the cursor over the target area of the image and click to create a cross hair marker

2 Click Live Move. The Live Move button changes to include a dotted line box to indicate that the recentering is being implemented.

To recenter image on a new location using a saved image:

1 Position the cursor over the target area of the image and click to create a cross hair marker.

2 Click Stored Move. The Stored Move button icon changes to a cross hair to indicate that the recentering is being implemented.

Full Scale

Expands the region of interest marquee to the default full image size during image acquisition, and when applying the Alter Contrast command to a saved image (see pages 23 and 32)

Vertical

Toggles vertical illuminator lamp on and off.

- Blue letters indicate that the lamp is on, and the lamp dial in the indicator panel can be used to override the default illumination level.

Internal

Toggles enclosure lamp for ambient illumination on and off.

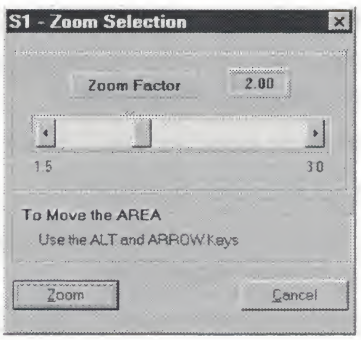
- Blue letters indicate that the lamp is on, and the lamp dial in the indicator panel can be used to override the default illumination level.
- The enclosure lamp is automatically turned off during image acquisition.

Overlay

Activates process for overlaying corresponding saved emission and illuminated images (see page 33).

Zoom

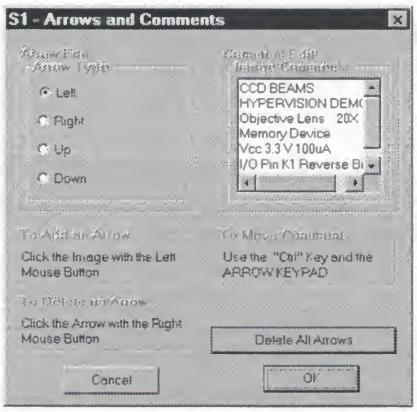
Creates an image in new window with a digitally magnified view of the selected area of the original saved image.



- Specify a magnification level by moving the Zoom Factor slider.
- To move the designated zoom area in pixel increments, press Alt + the appropriate keyboard arrow key.
- When the Zoom selection marquee encloses the area you want to see enlarged, click Zoom.

Comments

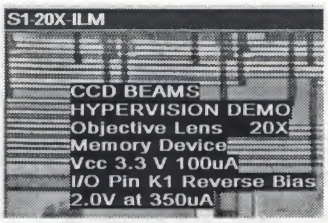
Arrows and comments can be added to a saved image, using the Arrows and Comments dialog. These elements are editable. They are maintained on a superimposed layer, and do not affect the data of the underlying image.



To add an arrow as a location marker, select an arrow direction under Arrow Type and click the active image at the desired location using the left mouse button

- Arrows are displayed only in full sized active image windows.
- To delete an arrow, right-click it.

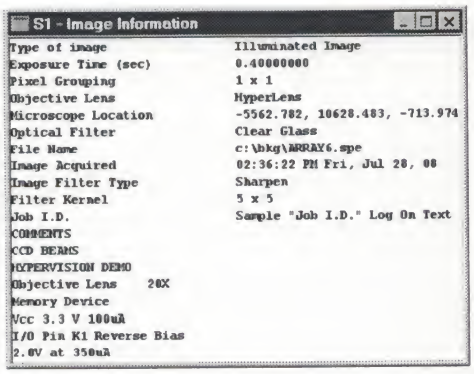
To add an editable comment to an active image window, type your information into the Image Comments field, and click OK.



- Comments are displayed only in full sized active image windows.
- To move the comments incrementally to another location in the image area, press Ctrl + appropriate arrow keys.
- To revise comments, access the editable text in the Arrows and Comments dialog.
- To remove comments from an active image window, delete the information from the Image Comments field.

Image Info

Displays the Image Information window, which provides background file data of the selected image.



- Job I.D. information is entered during the logon procedure (see page 3).
- Comments are entered and edited using the Arrows and Comments dialog (see page 20).
- A separate, printable,text file containing the Hypervision data displayed in the Image Information window is generated automatically when an image is acquired (see page 47).

Clear

Clears active image and image group windows from the image viewing area.

Joystick control palette

Provides an alternate digital interface to the hardware joystick.

X, Y, Z (+/-) controls

Right-click on the appropriate arrow buttons to move the probestation platform under the microscope along either the X-, Y-, or Z-axis.

Speed

Select Low, Medium, or High to specify speed of joystick controlled image motion.

Active Space

Select Prober Space or Chip Space to define area of joystick operation.

Move Scope Position

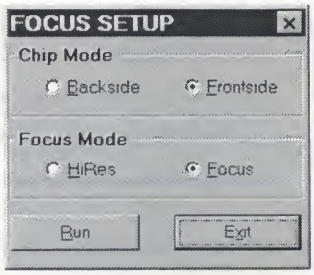
Enter the numerical X-, Y-, and Z-axis values for a location that you want centered in your image area, and right-click the GO button to initiate.

This page intentionally left blank.

Chapter 2: Acquiring Images

In this chapter, we will proceed step by step through the procedures you will use to acquire images for analysis using the BEAMS System Software. We begin the acquisition procedures assuming that you have positioned a device on the probe station chuck centered beneath the optic path of the microscope.

Illuminated images



To acquire an illuminated image:

1 Click Illum. Image in the control panel.

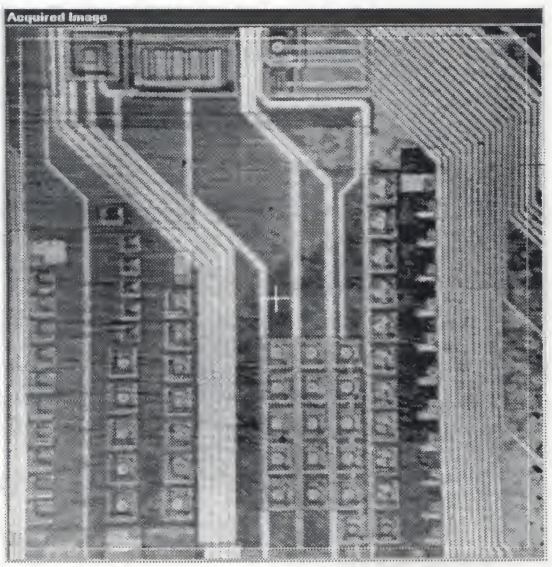
2 In the Focus Setup dialog:

- Select Backside or Frontside under Chip Mode.
- For rapid image acquisition while focusing, select Focus (0.1 seconds/frame exposure time) under Focus Mode. The HiRes option is a slower acquisition rate (0.9 seconds/frame exposure time).
- Click Run.

3 The vertical lamp is automatically activated, with Auto selected by default.

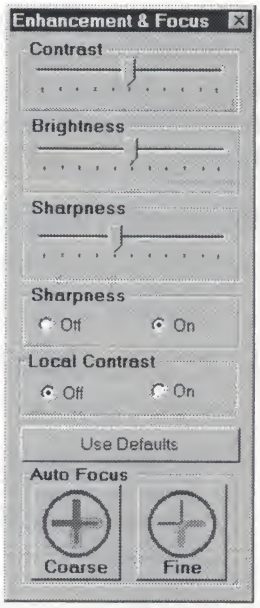
- The illumination level can be manually controlled by deselecting Auto, and clicking the circumference of the lamp dial.

4 Any buffer memory images are cleared from the image display area, and replaced by the Acquired Image window.



- The red cross hair marker designates the focal center of the acquired images.
- The red box within the perimeter of the image defines the default area, or region of interest (ROI) used by the BEAMS System Software as a baseline to calculate contrast values. To target a specific region of the image for use as the basis for determining your image contrast, click-drag a selection marquee around that area.
- To return the ROI to the default setting, click Full Scale.
- To recenter the image, click on the desired feature to position a cross hair marker, and click Live Move.

5 The Enhancement & Focus dialog appears simultaneously with the Acquired Image window, with default settings applied for brightness, contrast, and sharpness.



- The Contrast, Brightness, and Sharpness controls in the Enhancement & Focus dialog are identical to those in the Image menu accessed with the Alter Contrast and Enhance commands, except that they allow you to optimize image quality during the acquisition process. Image menu commands can only be applied to saved images (for detailed information, see page 37).
- Auto Focus is a function of the BEAMS System Software that calculates a definition of image focus based on image content.

  To use the Auto Focus command click Coarse. This begins a focusing process that entails an upward z-axis movement of the scope in large increments until a general focal range is reached.

  The process then automatically switches to focusing in the Fine mode which entails scope movement in smaller increments in either direction on the z-axis until focus is optimized.

  To focus on a specific area of a device, click-drag a new region of interest, and click Fine.

  NOTE: *The Coarse mode moves the scope on the Z-axis away from the prober chuck. If the image becomes progressively less focused as Auto Focusing continues, click the Auto Focus Stop button to cancel the operation, and use the joystick controls to manually lower the scope back into approximate focus, and click Fine.*

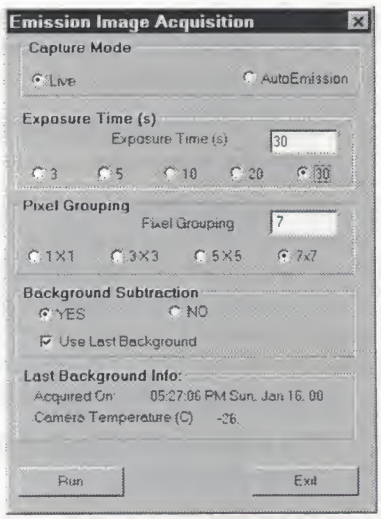
  To cancel Auto Focusing, click the Auto Focus Stop button.

6 Illuminated images are acquired in continuous succession, with each succeeding image replacing its predecessor in the active image window. When the image is centered on the target interest area, and the focus and image quality are satisfactory, click Stop in the control panel.

- The total number of images acquired is displayed in the Frames field.
- The final image of the sequence is saved to buffer memory, and displayed in the S1 pane of the image stack.
- Each saved image is automatically assigned a file name that includes the image stack pane number, the lens used to acquire it, and the type of acquisition. For example: S1-5X-ILM.

7 As subsequent images are acquired and saved to buffer memory, they are displayed initially in the S1 pane, and shuttled sequentially into panes S2 through S8.

Emission images



Emission images are acquired with the infrared bandpass filter in the optical light path. By eliminating stray photons of other wavelengths, the filter produces emission images consisting only of photons in the infrared wavelength.

To acquire an emission image:

1 Shut the microscope enclosure doors.

2 Click Emission in the control panel.

3 The Emission Image Acquisition dialog appears.

- Under Capture Mode, select Live or AutoEmission.

  Images acquired in Live mode are cumulatively superimposed on the previous image in the active image window until the acquisition is ended.

  The AutoEmission mode allows for the automated capture of separate emission images of multiple devices on a single wafer, which are stored sequentially in buffer memory. Images can be acquired in the AutoEmission mode only if your probe station is equipped for this process.

- Under Exposure Time(s), select from the Default options (3, 5, 10, 20, or 30 seconds), or enter a custom value directly into the Exposure Time field.
- Under Pixel Grouping, select from the default options (1x1, 3x3, 5x5, or 7x7), or enter a custom value directly into the Pixel Grouping field.

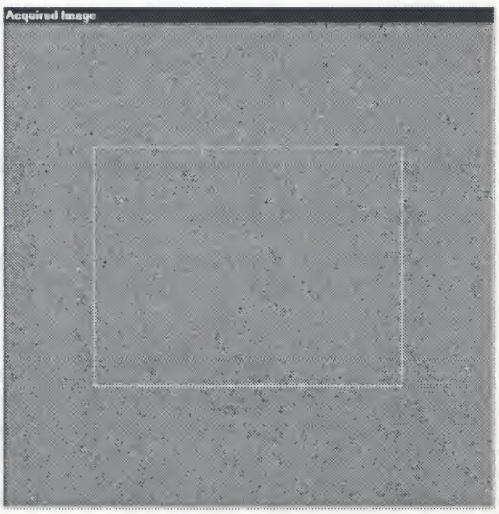
  Smaller pixel groups produce a higher resolution image with decreased sensitivity. Larger pixel groups produce a lower resolution image with increased sensitivity.

- Under Background Subtraction, if you select yes, and the Use Last Background option is selected, the Emission Image Acquisition dialog expands to display Last Background Info, and the background image appears in an active image window.
- If Background Subtraction is deselected, a new background image is automatically acquired, and appears in an active image window.
- To begin emission image acquisition, click Run.

4 The Backside Inspection Windows Application dialog appears with a reminder to apply power to the device being tested.

- Confirm that power is applied to the device being tested, and click OK.

5 Live mode emission images are refreshed with each successive image acquisition. In contrast, Accumulate mode emission images (BEAMS software versions 8.1 and earlier) are acquired in continuous succession, with the data from each emission image cumulatively added to that of the previous image, allowing the luminance to build to visible levels.



- The total number of images acquired is displayed in the Frames field.
- The exposure progress of each image acquisition is displayed by the status indicator.
- To redefine the default region of interest, click-drag to select another area.
- When the image quality is satisfactory, click Stop in the control panel.
- The final image of the sequence is saved to buffer memory S1.
- Each saved image is automatically assigned a file name that includes the image stack pane number, the lens used to acquire it, and the type of acquisition. For example: S1-5X-EMS.

Scan Image

Allows you to acquire tiled, composite illumination and emission images of a device that is larger than the field of view of any given lens by programming the probe station to move the lens relative to four corner points on the device designated using the Scan Image dialog.

To acquire a scanned image:

1 Set up the DUT or wafer to acquire an emission image.

- If only an illuminated image is required, disregard the emission image setup.

2 Next, acquire the illuminated image or images that will serve as the basis for the final composite scanned image. Typically the base image is acquired using a lower magnification lens than that used for the composite scanned image.

- If a single Hyperlens image provides both a wide enough field of view and enough detail to locate the four corner points on the device, copy that image four times into F1, F2, F3, and F4.
- If higher magnification is required to locate the corner points, acquire four separate images, using the joystick and/or the Live Move command to center the images on the target corner points, starting with the upper left corner and proceeding clockwise. Copy the images in the order acquired into F1, F2, F3, and F4.

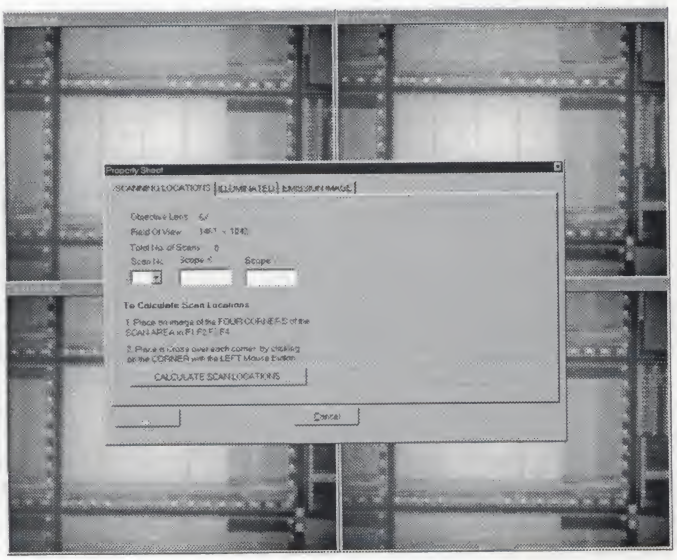
3 Click the appropriate control panel lens button to select the higher magnification lens to be used for the composite scanned image.

4 Select Image > Scan Image.

5 The Scan Image dialog opens, along with F1, F2, F3, and F4.

6 Place the cross hair markers that will define the corners of the composite scanned image:

- Click on the upper left corner point in F1.
- Click on the upper right corner point in F2.
- Click on the lower right corner point in F3.
- Click on the lower left corner point in F4.

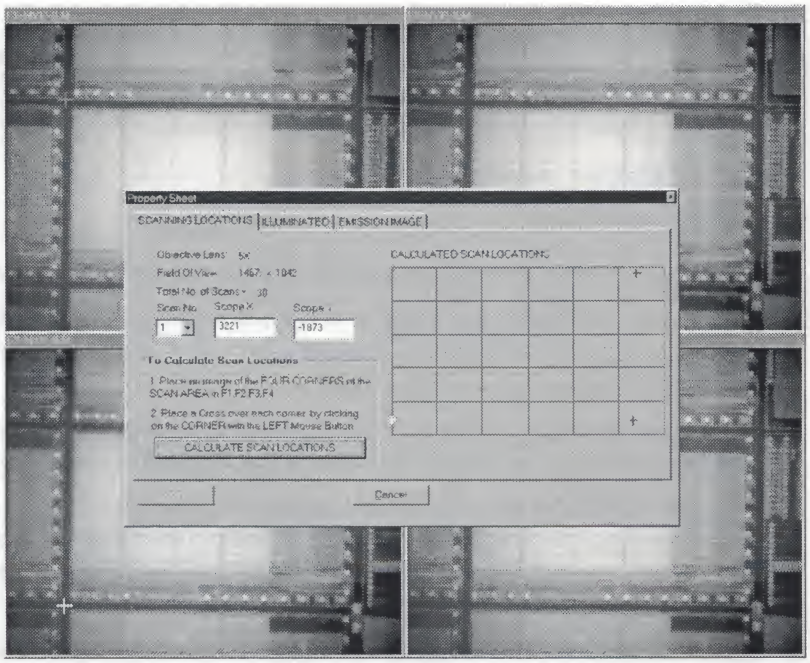


7 Click Calculate Scan Locations.

8 BEAMS System Software calculates the number of higher magnification images that will be required to compile the larger composite image, and displays a schematic grid of the images, showing the cross hair corner locations.

9 Click the Illuminated Image tab to configure parameters for the illuminated image scans.

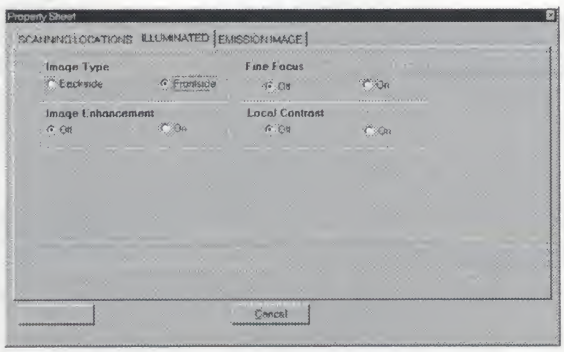
- Select Image Type, Image Enhancement Fine Focus, and Local Contrast options.

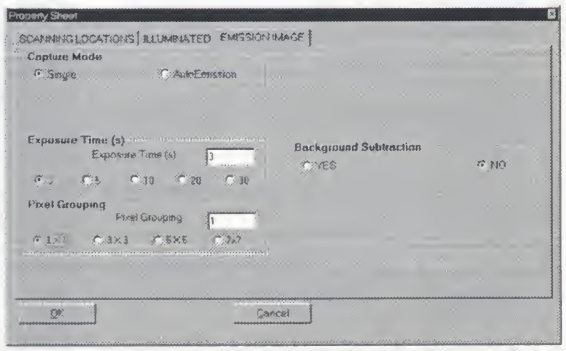


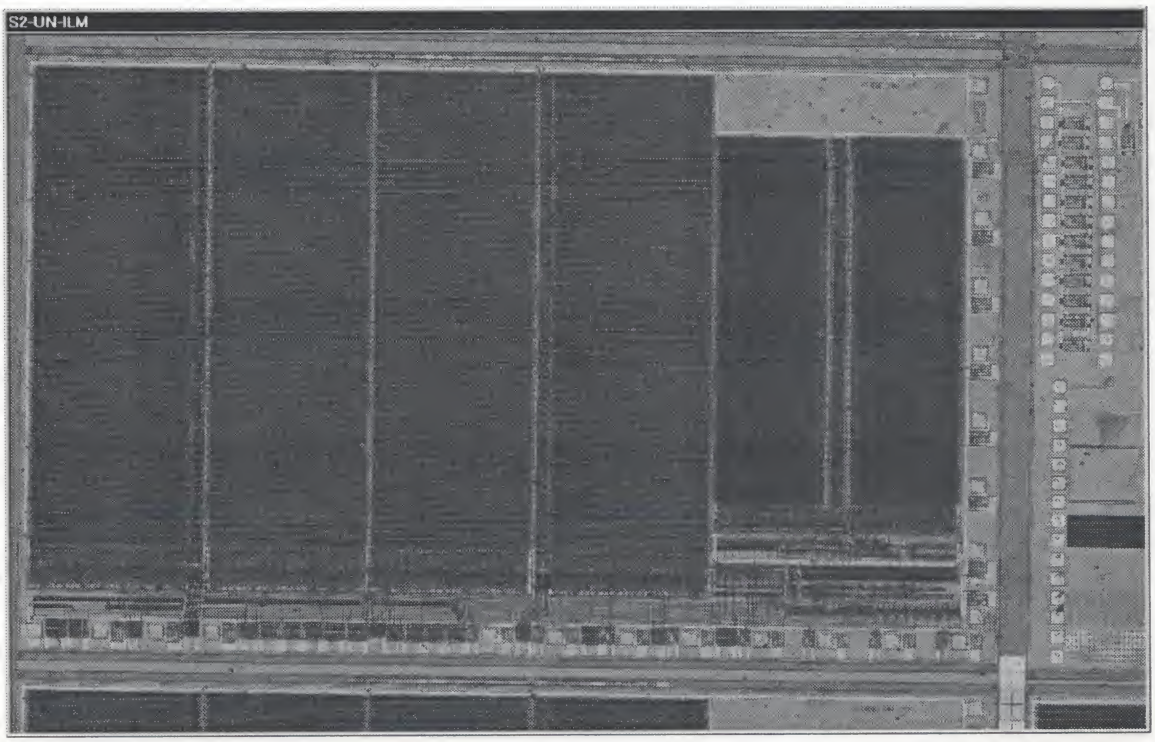
10 Click the Emission Image tab to configure parameters for the emission image scans.

- Select Capture Mode, Exposure Time, Background Subtraction, and PIxel Grouping options.

11 To begin the scan image acquisition process, click OK.





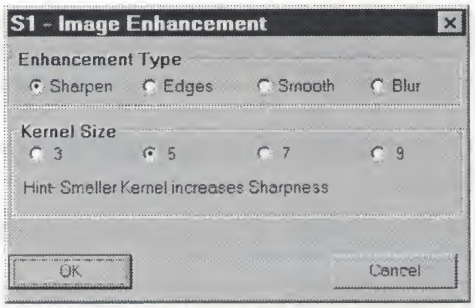


12 The composite scanned image is displayed following acquisition and compilation of the component images.

This page intentionally left blank.

Chapter 3: Enhancing and Processing Saved Images

Image enhancement



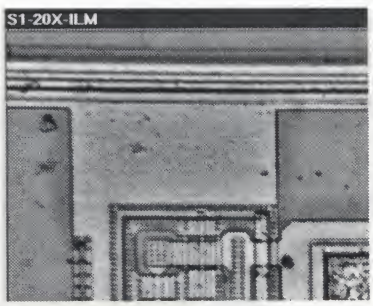
To apply an image enhancement filter to a saved image:

1 Double-click the saved image to open it in the active image window, or select File > Open to open a file saved to an outside directory.

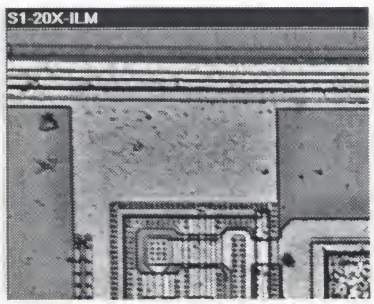
2 Select Image > Enhance. In the Image Enhancement dialog, select from the following options:

- Under Enhancement Type, select from the Sharpen, Edges, Smooth, and Blur filters.
- Under Kernel Size, select 3, 5, 7, or 9. Kernel size refers to the pixel grouping used to calculate application of the filter.

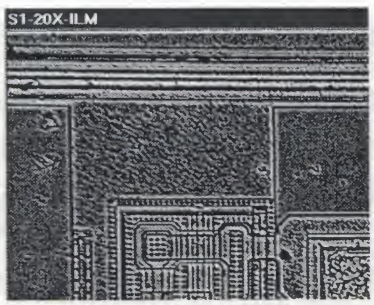
3 Click OK.



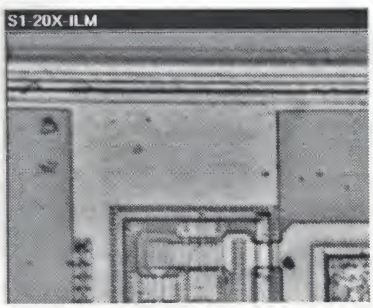
Original image



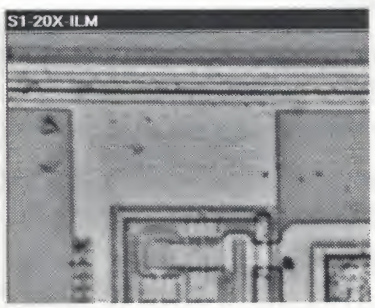
Sharpen filter



Edges filter



Smooth filter



Blur filter

Alter Contrast

Provides controls to adjust the contrast and brightness of saved illumination and emission images. For overlay images, contrast and brightness controls are provided for independent adjustment of the illumination and emission image layers, as well as a control for adjusting the emission threshold.

Contrast and Brightness Adjustment for Illuminated and Emission Images

To adjust contrast and brightness of a saved illumination and emission image:

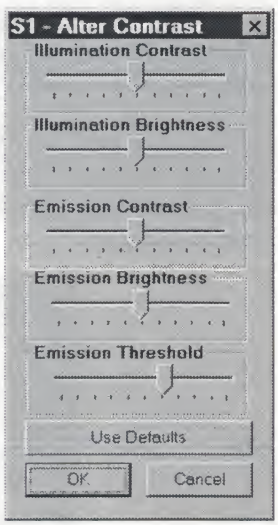
1 Double-click the saved image to open it in the active image window, or select File > Open to open a file saved to an outside directory.

2 Select Image > Alter Contrast. In the Alter Contrast dialog:

- To adjust contrast and brightness, click-drag the slider controls.
- To restore the original contrast and brightness levels, click Use Default.

3 To apply the adjustments, click OK.

Contrast, Brightness, and Threshold Adjustment for Overlay Images



To adjust contrast and brightness of a saved overlay image:

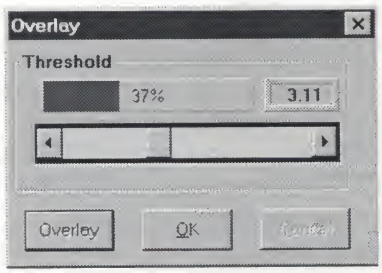
1 Double-click the overlay image to open it in the active image window, or select File > Open to open a file saved to an outside directory.

2 Select Image > Alter Contrast. In the Alter Contrast dialog:

- To adjust the illumination image contrast and brightness, click-drag the slider controls.
- To adjust the emission image contrast and brightness, click-drag the slider controls.
- To adjust the emission image threshold, click-drag the slider controls.
- To restore the original contrast, brightness, and threshold levels, click Use Defaults.

3 To apply the adjustments, click OK.

Overlay



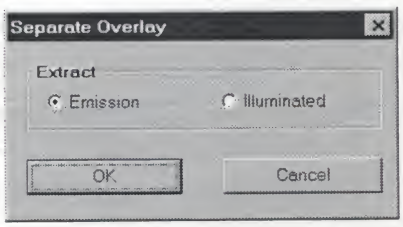
The Overlay command integrates data from an illuminated image and an emission image into a single image file that retains the original data of both sources, and allows you to dynamically manipulate the composite image to best render the presentation of the emission data against the background of the physical chip architecture.

To overlay corresponding emission and illuminated images saved to the image stack, click Overlay in the control panel.

1 In the Overlay dialog, specify emission image saturation by moving the Threshold slide bar, and click Overlay. If the initial result is not satisfactory, you can repeat this process as many times as necessary.

2 When you have an optimal saturation value, click OK.

Separate Overlay

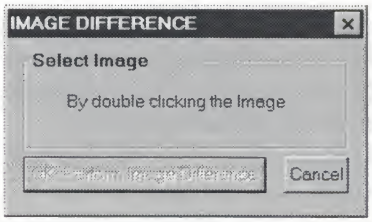


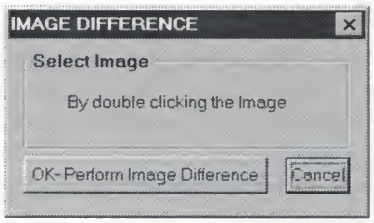
To convert a saved overlay image file back to the original. emission and illumination image files, open the image, and select Function > Separate Overlay.

1 Under Extract, select Emission or Illumination.

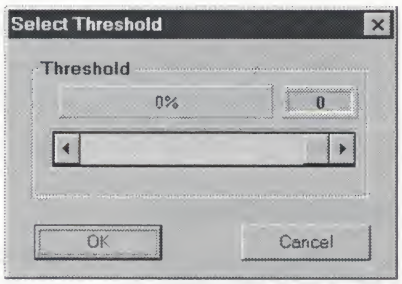
2 Click OK.

Image Difference





The Image Difference command allows you to subtract the emission pixels in a nonfailed state DUT image from those in an image of the DUT in a failed state, producing an image containing only failed state emission pixels.



To apply the Image Difference command:

1 Acquire an emission image of your DUT in a nonfailed state, and save it to F1.

2 Using the same lens and focus setting, acquire an emission image of your DUT in a failed state, and save it to F2.

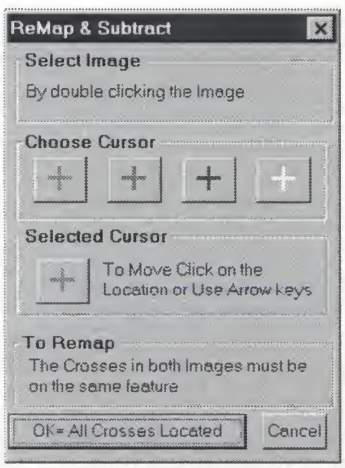
3 Select Function > Difference.

4 When the Image Difference dialog appears, first double-click F1, and then double-click F2 to load them into the active image area.

   • Click OK-Perform Image Difference.

5 In the Select Threshold dialog, specify a luminance threshold level for the emission pixels, and click OK.

Remap Difference



The Remap Difference command allows you to subtract the emission pixels in a nonfailed state DUT image from those in an image of another DUT in a failed state, producing an image containing only failed state emission pixels, by mapping a common feature of each DUT with four points in each image.

To apply the Remap Difference command:

1 Acquire an emission image of the nonfailed state DUT,

   • Choose a prominent feature of interest common to both or all of the DUTs, and use the Live Move command to center it in the image.

   • Save the image to F1.

2 Using the same lens and focus setting, acquire an emission image of the failed state DUT.
   - Locate the common feature of interest, and use the Live Move command to center it in the image.
   - Save the image to F2.

3 Select Function > Remap Difference.

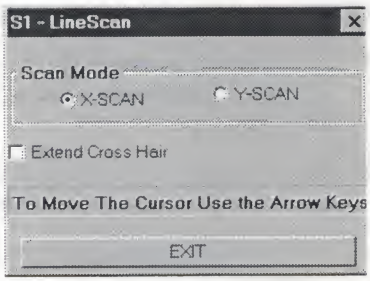
4 When the Remap & Subtract dialog appears:
   - Double-click F1 to load it into the active image area.
   - Under Choose Cursor, successively click each of the four cross hair buttons and, after positioning the cursor over a corner of the common feature, click to locate a cross hair marker.
   - After locating all four cross hairs, double-click F2 to load it into the active image area.
   - Under Choose Cursor, successively click each of the four cross hair buttons and, after positioning the cursor over the same corners of the common feature with the same cursors as in F1, click to locate the cross hair markers.

5 Click OK-All Crosses Located.

This page intentionally left blank.

Chapter 4: Image Analysis

Line Scan



To display a line histogram of the pixels on a selected X- or Y-axis of a saved image:

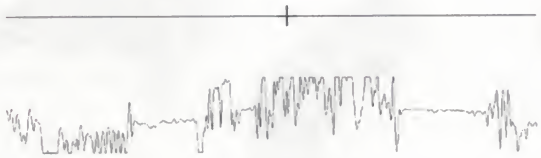
1 Double-click a saved image to open it in the active image window, or select File > Open to open a file saved to an outside directory.

2 Select Image > Line Scan. A default cross hair appears centered in the image area, along with its corresponding line histogram.

- To extend the cross hair cursor across the image area along the selected axis, click Extend Cross Hair.
- To move the cross hair cursor in pixel increments, press the appropriate arrow key.

3 To change the axis of pixels displayed as a histogram, click X-SCAN or Y-SCAN under Scan Mode.

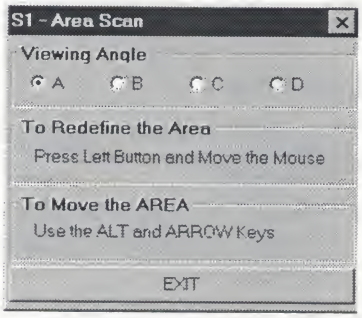
4 When you are finished, click EXIT.



X-axis extended cross hair and line histogram

Y-axis extended cross hair and line histogram

Area Scan



To display an three-dimensional histogram of the pixels in a selected rectangular area of a saved image:

1 Double-click a saved image to open it in the active image window, or select File > Open to open a file saved to an outside directory.

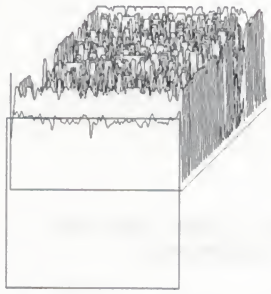
2 Select Image > Area Scan. A default ROI and its corresponding area histogram appears centered in the image area.

- Select a display angle from the four options under Viewing Angle.

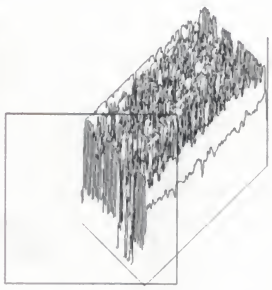
3 To redefine the ROI, click-drag a selection marquee around the area of the image you want to see displayed as a histogram.

- To move the selection marquee in pixel increments, press Alt + appropriate arrow key.

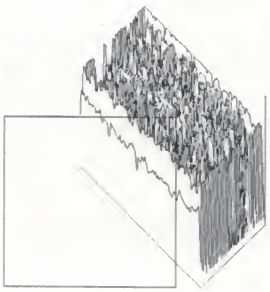
4 When you are finished, click EXIT.



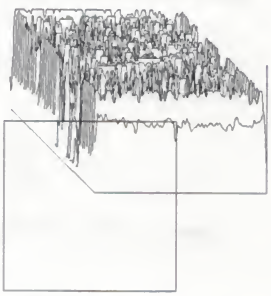
Viewing angle A area histogram and ROI



Viewing angle B area histogram and ROI



Viewing angle C area histogram and ROI



Viewing angle D area histogram and ROI

Chapter 5: Defining Chip Space

In this chapter, we will cover the chip space definition procedures used to map the digital images of devices acquired with your Hypervision system to their corresponding CAD engineering drawings.

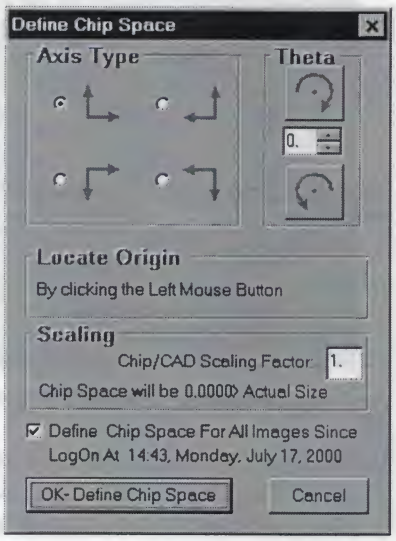
Define Chip Space

The chip space definition process is accomplished with either of two procedures:

- The first procedure, using the Define Origin and Axis calibration, sets the axis orientation of the CAD drawing relative to an origin point selected in the acquired image, determines the amount of theta correction needed for rectilinear alignment of the image to the CAD drawing, and establishes the chip/CAD scaling factor.
- An alternate procedure, using the Set Four Points calibration, establishes the numeric basis for the pixel-to-matrix mapping of the image to the CAD drawing.

Define Origin and Axis

To define chip space using the Define Origin and Axis calibration:



1 Acquire an illuminated image centered on a prominent rectangular feature of the DUT. This target feature will be used as a reference for determining the theta correction and scaling factor relative to the CAD drawing.

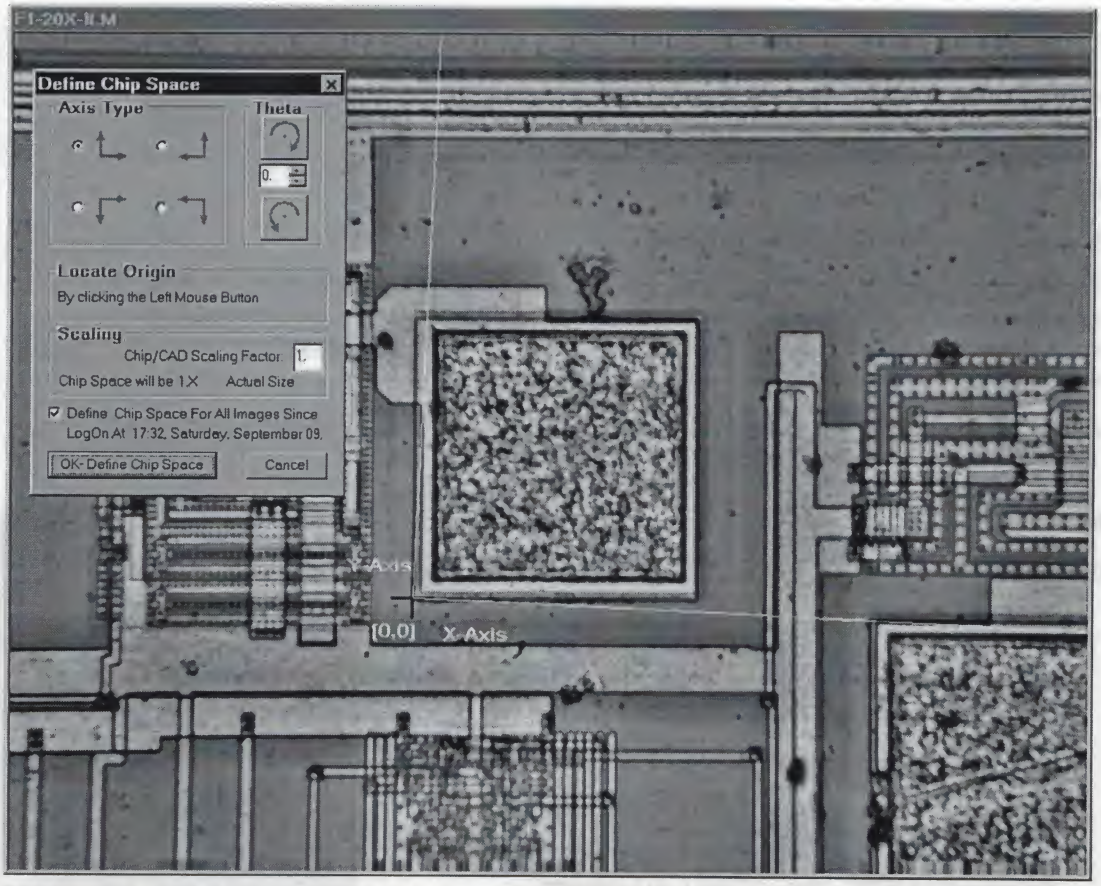
2 Select Function > Define Chip Space > Define Origin and Axis.

3 In the Define Chip Space dialog:

- Select an axis orientation under Axis Type, with reference to the orientation of the corresponding CAD drawing.

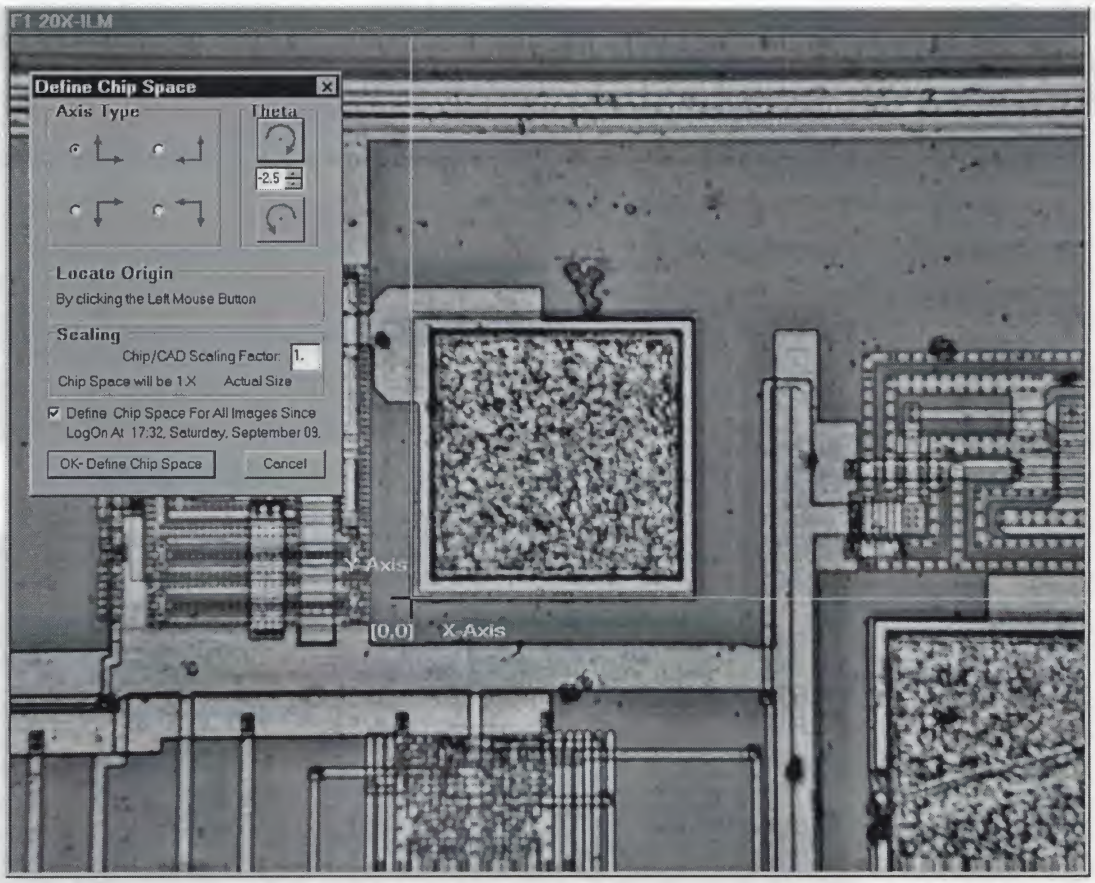
4 Position your cursor over the corner of the target feature that would be enclosed by the orientation of the selected axis type, and click to establish a cross hair location marker.

- An axis indicator representing the selected axis type is centered on the cross hair.
- If the cross hair is not accurately positioned over the corner of the target feature, you can click again to relocate it, or use the arrow keys to move it in pixel increments.



Origin cross hair and theta uncorrected axis indicators

5 When the cross hair is accurately positioned over the corner of the target feature, click either the clockwise or the counterclockwise buttons under Theta to increase or decrease the theta correction value in increments of 0.5 degrees until the axis indicator is aligned with the target feature.



Origin cross hair and theta corrected axis indicators

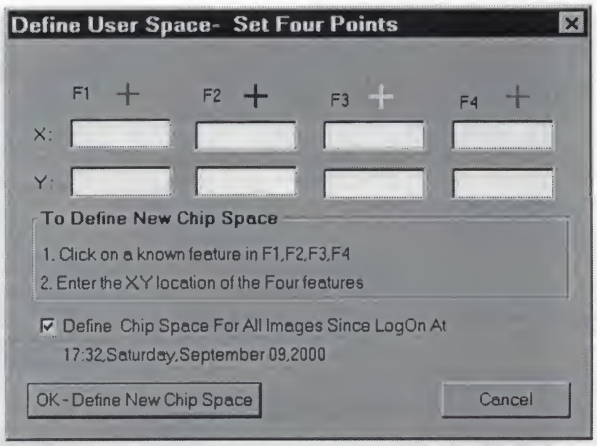
6 Obtain the chip/CAD scaling value from the CAD drawing, and enter it under Scaling.

7 The Define Chip Space For All Images Since Logon option is selected by default. If the chip space definition you are creating does not apply to all images acquired since your most recent logon, click the checkbox to deselect it.

8 To apply the axis type, theta correction value, and scaling factor, click OK–Define Chip Space.

Set Four Points

To define chip space using the Set Four Points calibration:



1 Acquire an illuminated image centered on a prominent rectangular feature of the DUT, and save copies of the image to F1, F2, F3, and F4.

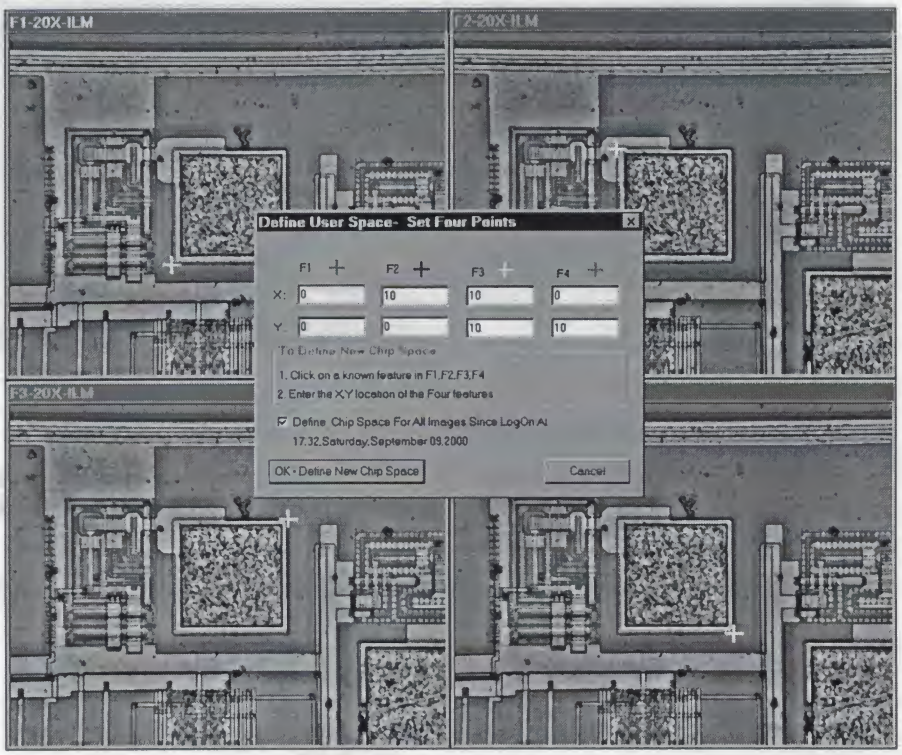
2 Double-click F1 to make it the active window.

3 Select Function > Define Chip Space > Set Four Points. The BEAMS System Software will automatically launch F1, F2, F3, and F4 as an image group.

4 Click the title bar of F1 to make it active, position the cursor over the lower left corner of the target feature, and click to establish a cross hair location marker.

5 In the Define User Space–Set Four Points dialog: under F1:

- Enter 0 in both the X and the Y fields.



6 Click the title bar of F2 to make it active, position the cursor over the upper left corner of the target feature, and click to establish a cross hair location marker. Under F2:

- Obtain the X-axis dimension, in microns, of the target feature from the CAD drawing, and enter this value in the X field.
- Enter 0 in the Y field.

7 Click the title bar of F3 to make it active, position the cursor over the upper right corner of the target feature, and click to establish a cross hair location marker. Under F3:

- Enter the X-axis dimension of the target feature in the X field.
- Obtain the Y-axis dimension, in microns, of the target feature from the CAD drawing, and enter this value in the Y field.

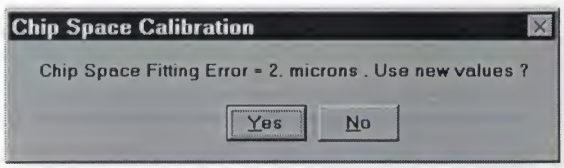
8 Click the title bar of F4 to make it active, position the cursor over the lower right corner of the target feature, and click to establish a cross hair location marker. Under F4:

- Enter 0 in the X field.
- Enter the Y-axis dimension of the target feature in the Y field.

9 The Define Chip Space For All Images Since Logon option is selected by default. If the chip space definition you are creating does not apply to all images acquired since your most recent logon, click the checkbox to deselect it.

10 To apply the dimensions of the target feature, click OK–Define Chip Space.

11 The Chip Space Calibration dialog appears, presenting you with the chip space fitting error. This is a measure of the deviation from true rectangularity of the four cross hair locations you established on the corners of the target feature. The amount of chip space fitting error that is acceptable depends on the size of the target feature, as well as the degree to which the image is magnified.



- If the chip space fi tting error is acceptable, click Yes.

12 If the chip space fi tting error is not acceptable, click No, and select Function > Define Chip Space > Set Four Points.

13 Visually determine which of the four cross hairs is furthest from its corner location on the target feature, and click the title bar of that window to make it active. Use arrow keys to move the cross hair closer to its corner, and click OK–Define Chip Space.

14 If the chip space fi tting error is acceptable, click Yes

- If the chip space fitting error is not acceptable, click No, and repeat steps 8 and 9 until an acceptable parameter is achieved.

Chapter 6: Saving and Printing Images

Individual User Workspaces

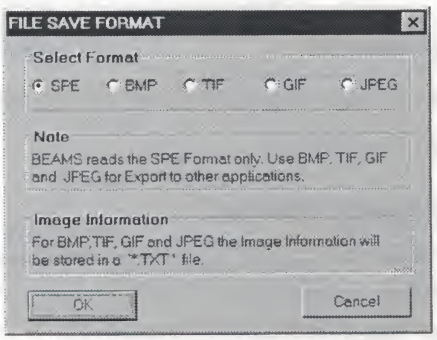
BEAMS version 8.01 introduces the concept of individual user workspaces to the BEAMS desktop. This means that each user who logs onto the microscope will see their own images arrayed across the bottom of the display in the S1 through S8 and F1 through F8 image thumbnails.

As each new user logs onto the system, two sub-directories are created. The first is in the C:\bkg directory, with the same name as the user. For example, someone logging on with the user name "Alpha" will generate a C:\bkg\Alpha directory. The 16 scratch and fixed image stack files will be stored in this directory.

The second sub-directory created will also have the same name as the user, but will be located in the C:\usr directory (C:\usr\Alpha). This sub-directory is where the user's images can be saved. In addition, whenever any user elects to save an image, the default "save to" directory will be C:\usr\username*.*.

Saving Images

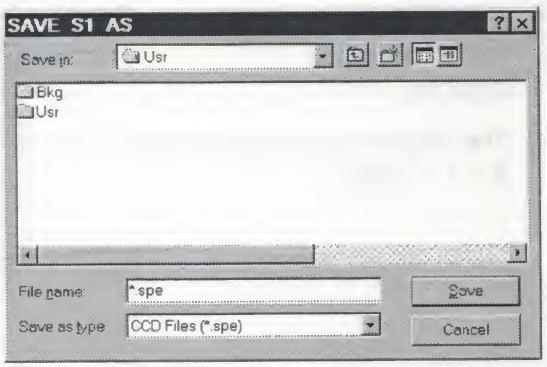
To save the image displayed in the active image window to any designated directory on your internal hard drive, to a networked hard drive, or to removable media:



1 Select Save from the File menu.

2 The File Save Format dialog appears. Under Select Format, specify a graphic format:

- Select the SPE format if the file is intended for future use with the BEAMS System Software.
- Select from the BMP, TIF, GIF, or JPEG graphic formats for use with other applications.
- Hypervision data, as displayed in the Image Information window, is saved as a separate text file.



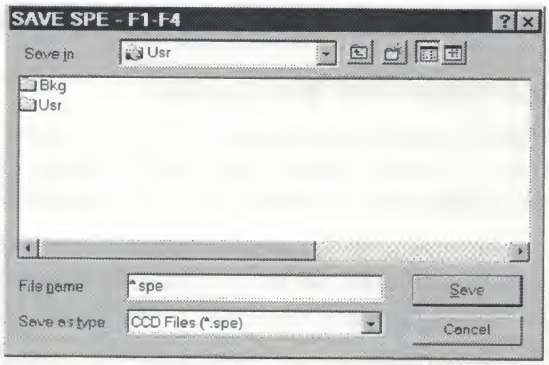
3 Click OK.

4 In the standard Windows Save As dialog, assign a file name.

- Files are saved by default to the Usr folder.

5 Click Save.

Saving Image Groups



To save the image group designated in the image group selector (see page 17) to any designated directory on your internal hard drive, to a networked hard drive, or to removable media as a single file in any of the above formats, with each image displayed in a separate quadrant:

1 Select Save Group from the File menu.

2 The File Save Format dialog appears. Under Select Format, specify a graphic format:

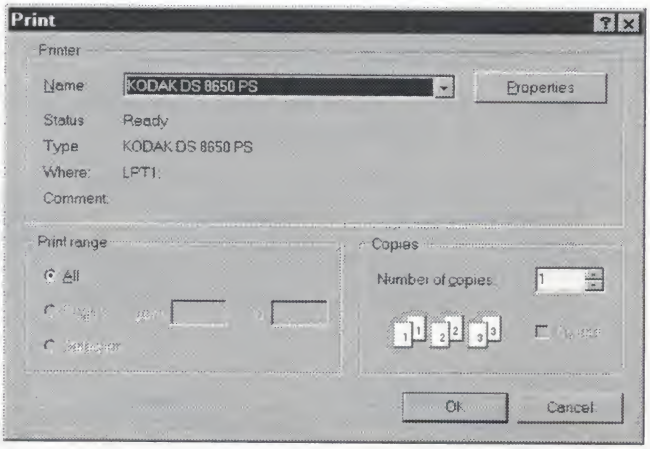
- Select the SPE format if the file is intended for future use with the BEAMS System Software.
- Select from the BMP, TIF, GIF, or JPEG graphic formats for use with other applications. Hypervision data, as displayed in the Image Information window, is saved as a separate text file.

3 Click OK.

4 In the standard Windows Save dialog, assign a file name.

5 Click OK.

Printing Images



To print the image displayed in the active image window:

1 Select Print from the File menu.

2 In the Print dialog, specify the number of copies.

3 Click OK.

4 The image is automatically scaled to fit an 8.5" x 11" page.

Printing Image Groups

To print the image group designated in the image group selector (see page 17):

1 Select Print Group from the File menu.

2 In the Print dialog, specify the number of copies.

3 Click OK.

4 The four images are automatically scaled to fit an 8.5" x 11" page.

Printing Image Information data

To print the data displayed in the Image Information window, first save the image as a file (see page 45), and using the standard Windows Text Editor, open the file with the TXT extension

1 Select Print from the File menu.

2 In the Print dialog, specify the number of copies.

3 Click OK.

This page intentionally left blank.

Chapter 7: Calibration Procedures

In this chapter, we will cover calibration procedures necessary to insure an accurate interface between the BEAMS System Software and your Hypervision emission microscope system.

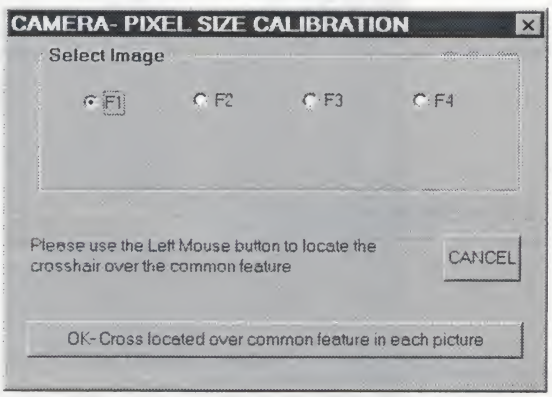
Hardware Calibration

The PixelSize and Parcenter calibration procedures are used to correlate the pixel grid of the microscope camera's CCD imaging chip with the probestation's millimeter-based movement system. These are factory calibrations that ordinarily do not need adjustment, except under certain conditions, such as:

- Replacement of the camera.
- Replacement of a lens, or impact to a lens or the lens turret.
- Extended use of the system requiring recalibration to adjust for normal wear.

PixelSize

Creates compensation tables that establish correct linearity between each lens and the probe station platform movement. To perform the PixelSize calibration:



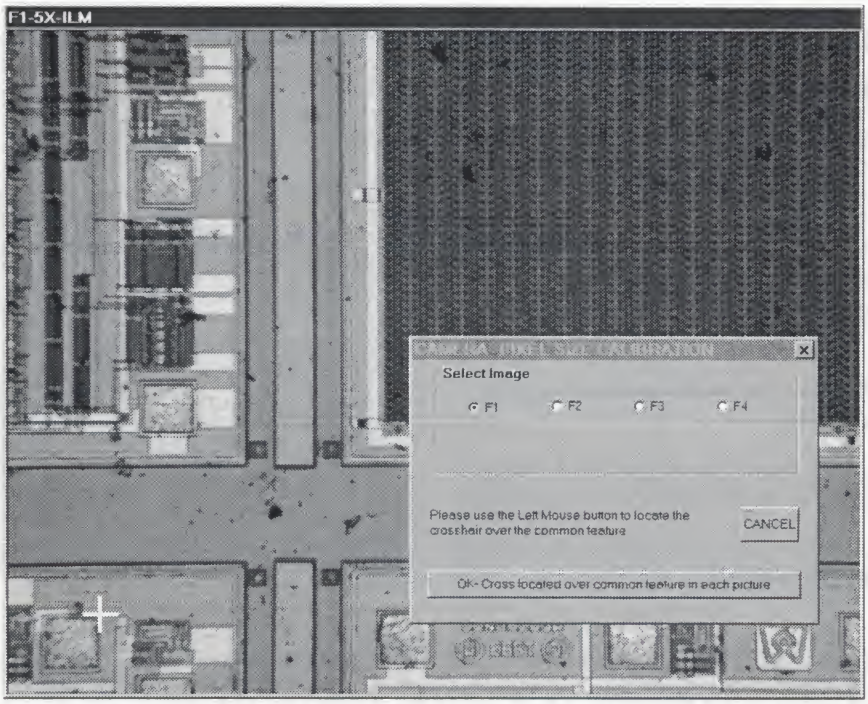
1. Click Illum. Image to begin acquisition of an illuminated image.
2. Choose a unique and easily identified feature of the DUT to serve as a target for the calibration.
3. Using the joystick, move the target feature within the image area to a corner, and save the image to F1.
4. Click Illum. Image to begin acquisition of a second illuminated image.
5. Using the joystick, move the target feature within the image area to a second corner, and save the image to F2.
6. Click Illum. Image to begin acquisition of a third illuminated image.
7. Using the joystick, move the target feature within the image area to a third corner, and save the image to F3.
8. Click Illum. Image to begin acquisition of a fourth illuminated image.

9 Using the joystick, move the target feature within the image area to the fourth corner, and save the image to F4.

10 Select Hardware > Calibration > PixelSize.

11 In the Camera-Pixel Size Calibration dialog, under Select Image, click F1. F1 displays in the active image window.

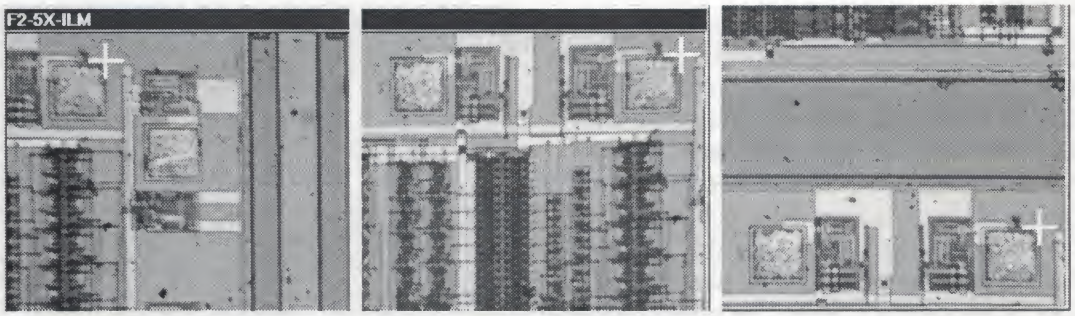
12 Position the cursor over a corner or otherwise easily identified point of the target feature, and click to create a cross hair location marker.



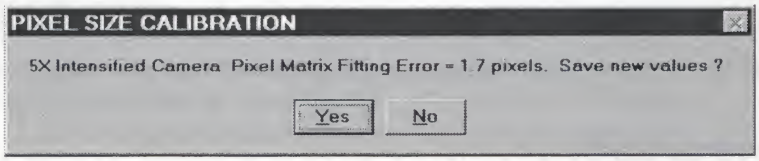
F1 cross hair

13 Repeat steps 11 and 12 for F2, F3, and F4, being careful with each image to position your cursor as accurately as possible on the same point of the target feature located in the corners.

14 Click OK-Cross located over common feature in each picture.



F2 cross hair *F3 cross hair* *F4 cross hair*



15 Since it is difficult to initially position the cross hairs with the accuracy required for this calibration, It is likely that you will need to adjust the location of one or more of the cross hairs in the different images. The Pixel Size Calibration message will display the variance between cross hair locations among the four images.

- The recommended minimum pixel matrix fitting error is ≤ 1 pixel. If the pixel matrix fitting error is within this parameter, click Yes.

16 If the pixel matrix fitting error is larger than 1 pixel, click No.

17 Select Hardware > Calibration > Pixel Size.

- By sequentially selecting among F1, F2, F3, and F4, visually determine which of the four cross hairs is furthest from the shared corner location of the target feature and use the arrow keys to move it closer to that location.
- Click a window on the title bar to make it active, or you will inadvertently relocate the cross hair.

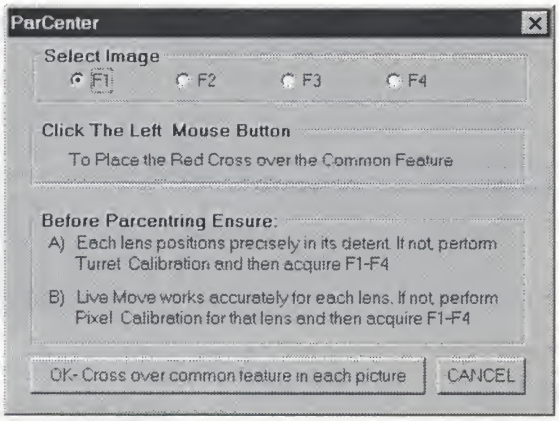
18 Click OK-Cross located over common feature in each picture.

- If the pixel matrix fitting error is ≤ 1 pixel, click Yes. If not, click No, and repeat steps 17 and 18 until the pixel matrix fitting error is ≤ 1 pixel.

19 Repeat the pixel size calibration for each lens. When the pixel size calibration for all four lenses has been completed, proceed to the ParCenter calibration, also required for all four lenses.

ParCenter

ParCenter allows to calibrate the field of view centers of the microscope lenses to a common point. The ParCenter calibration requires an accurate PixelSize calibration. This can be easily checked by visually confirming that use of the Live Move command accurately centers a subsequently acquired image on the point designated by the Live Move cross hair. Start with the Hyperlens and test all four lenses using the Live Move command. If the Live Move command works accurately for all lenses, proceed directly to ParCentering. If not, the PixelSize calibration must be performed first.



NOTE: *To insure that the device used to acquire the images required for ParCentering does not shift position during the procedure, it is recommended that you use a wafer, because it provides a flat surface that will be held in place by the chuck vacuum.*

To perform the ParCenter calibration:

1 Using the Hyperlens, acquire an illuminated image, with a prominent feature of interest centered in the image area using the Live Move command.

- It is important that this feature be easily distinguishable by its location and shape.
- Save the image to F1.

2 Using the 5X lens, acquire an illuminated image, with the feature of interest centered in the image area using the Live Move command.

- Save the image to F2.

3 Again using the Hyperlens, acquire another illuminated image to confirm that the feature of interest is centered in the image. Because of the difference in magnification, it may require some trail and error to accurately center the feature of interest in the Hyperlens image.

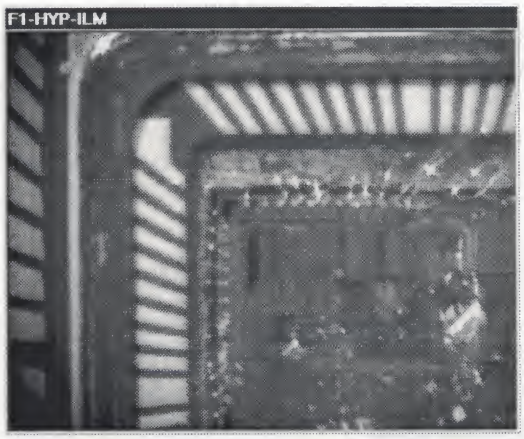
- If necessary, save the new image to F1.

4 Using the 20X lens, acquire an illuminated image, with the feature of interest centered in the image area using the Live Move command.

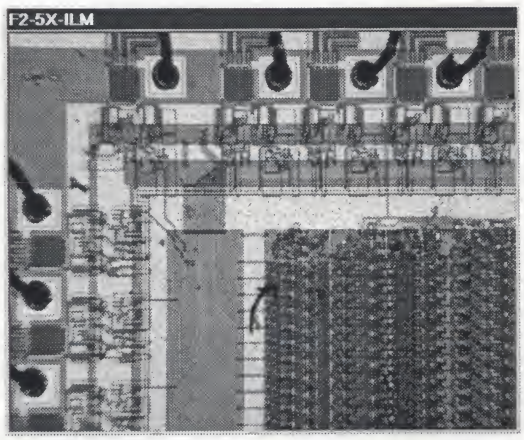
- Save the image to F3.

5 Using the 50X, or if installed, the 100X lens, acquire an illuminated image, with the feature of interest centered in the image area using the Live Move command.

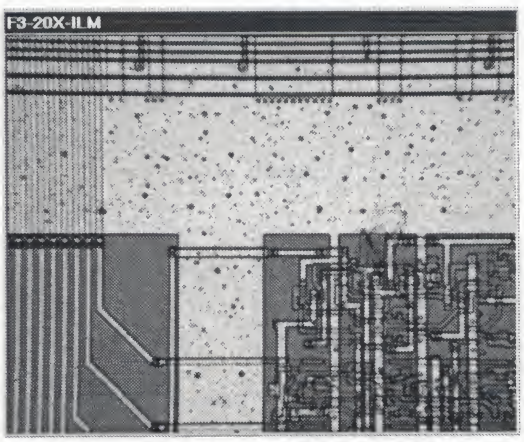
- Save the image to F4



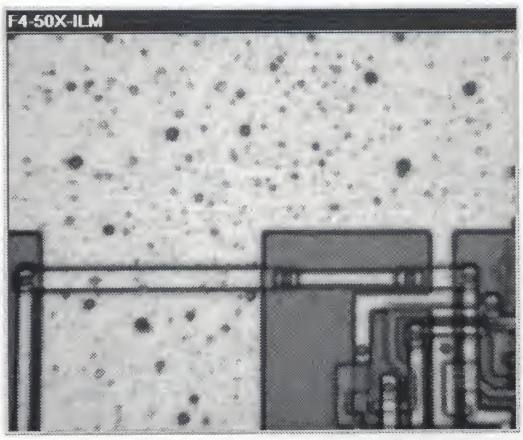
F1: Hyperlens image with centered feature of interest



F2: 5X image with centered feature of interest



F3 20X image with centered feature of interest



F4: 50X image with centered feature of interest

6 Select Hardware > Calibration > ParCenter.

7 In the ParCenter dialog, select F1, and click to locate a cross hair on the feature of interest.

- You can use the arrow keys to move the cross hair in pixel increments.

8 Repeat step 8 for F2, F3, and F4, being careful to locate the cross hair as accurately as possible.

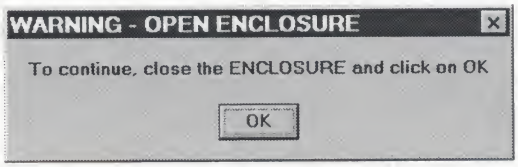
9 Click OK-Cross over common feature in each picture.

This page intentionally left blank.

Appendix A: Common Error Messages

Procedural warning

Open enclosure warning



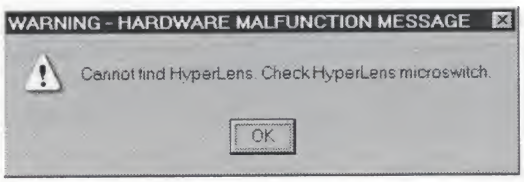
Message: "To continue, close the enclosure and click on OK"

Explanation: Emission images must be acquired in absolute darkness.

Likely Cause: The enclosure doors are not completely shut. Another possibility is that an enclosure switch is malfunctioning.

Hardware warnings

Hyperlens switch warning



Message: "Cannot Find Hyperlens. Check Hyperlens microswitch"

Explanation: When the operator selects any objective lens, the turret will rotate until the body of the Hyperlens closes the Hyperlens switch. At that point, the software knows the exact orientation and position of all lenses on the turret, and how far it needs to drive to arrive at the selected lens. The turret will rotate through two full rotations if necessary, and if the Hyperlens switch does not close during that time, this error message results.

Likely Cause: Look for a defective or misaligned Hyperlens micro-switch, or for wrong connection to the switch (see the hardware diagnostic procedure "Upper Hyperlens (UHL) motor" on page 67).

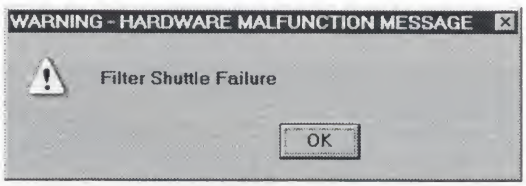
Lens movement warning

Message: "Lens is not moving. Check if it is jammed, and check the motor connection, and check its power level settings"

Explanation: This error occurs when the software does not receive the signal generated by the LED opto-interrupter, which "reads" the small holes along the rim of the turret assembly as it rotates. The lack of these signals is interpreted by the software to mean that the turret is not rotating, even if it actually is.

Likely Cause: Aside from the suggestions contained in the error message itself, one of the most common causes of this message is an open fuse in the 5V power supply inside of the power tray or a defective opto-LED (see the hardware diagnostic procedure "Turret" on page 65).

Filter shuttle warning



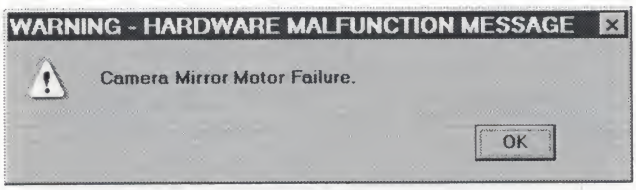
Message: "Filter Shuttle Failure."

Explanation: Filter shuttle does not move when commanded.

Analysis: The filter shuttle may be jammed,. Also, check the filter shuttle cable connection to the filter assembly, and the two limit switches in the shuttle housing and their associated wiring.

Likely Cause: Aside from the suggestions contained in the error message itself, one of the most common causes of this message is an open fuse in the 5V power supply inside of the power tray, or a defective opto-LED (see the hardware diagnostic procedure "Filter shuttle" on page 66).

Camera mirror motor warning



Message: "Camera Mirror Motor Failure"

Explanation: The BEAMS System Software allows a set amount of time to elapse during the travel of the mirror inside the optics tube. If, within that period of time, the software has not received the signal from the mirror's travel limit switch, this error message is generated.

Likely Cause: The most common source of this error is a broken or loose connection on the travel limit micro-switch inside the optics tube assembly. Less frequently, it can be caused by a defective mirror motor drive gear assembly, also inside the optics tube assembly (see the hardware diagnostic procedure "Mirror" on page 68).

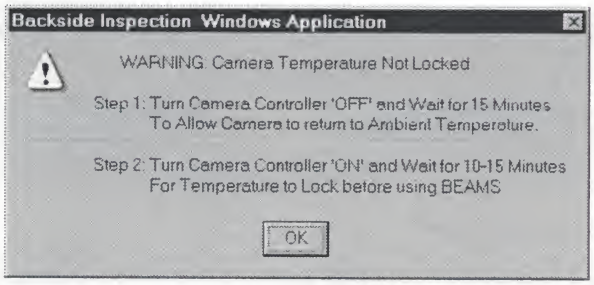
Optics motor warning

Message: "Optics Motor Malfunction. Check the optics cable."

Explanation: This message is generated much the same way as the "Mirror Motor Failure" error message, though for a different reason. There is a secondary lens inside the optics tube that moves into place in the optical path when the Hyperlens is selected. This lens moves back out of the optical path when the Hyperlens is de-selected, and movement both ways is by a motor that drives until travel limit switches are contacted.

Likely Cause: After a check of the optics cable to ensure that it is connected securely, the most common source of this error message would be a defective limit switch, a bad or broken connection to the limit switch, or (least likely) a bad motor (see the hardware diagnostic procedure "Upper Hyperlens (UHL) motor" on page 67).

Camera temperature warning

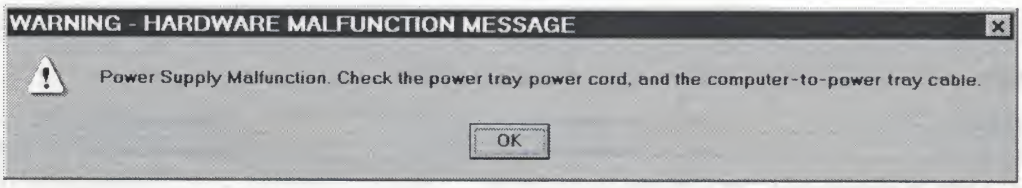


Message: "WARNING: Camera Temperature Not Locked"

Explanation: This error message is triggered when the actual camera temperature does not match the "PI Camera Temp" setting in BEAMS Configuration, and the camera controller has not locked.

Likely Cause: This message is usually generated as a result of excessive current being drawn by the camera's cooling circuitry, or by a mechanical failure of the camera cooling system. When the camera is having difficulty cooling, these circuits can draw excessive current, which the camera controller then senses. The controller reacts by sending a false (unattainable) temperature reading to shut off the cooling as a protective measure, and this "unlocks" the temperature circuits. Follow the directions in the error message to correct the situation. If the camera still does not obtain a temperature lock, contact Hypervision Technical Support for assistance.

Power supply warning

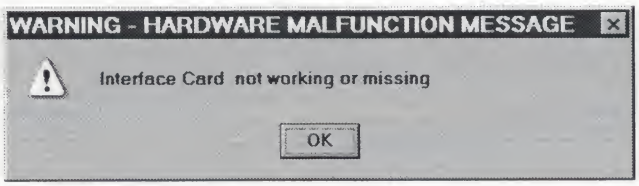


Message: "Power Supply Malfunction. Check the power tray power cord, and the computer-to-power tray cable."

Explanation: This error message is generated when the software returns a failed hardware argument for the power tray.

Likely Cause: If the power tray cord and the computer-to-power tray cable are OK, and properly connected, the most likely cause would be a blown fuse. A defective main power input fuse (on the outside of the power tray) or a defective 12V power supply fuse (inside the power tray) could generate this error message.

Interface card warning

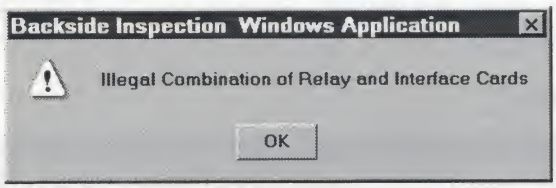


Message: "Interface Card not working or missing"

Explanation: This message is triggered by the Hypervision software returning an illegal result on a bit test.

Likely Cause: Self-explanatory; the interface card should be replaced with a good one of the proper version.

Relay and interface cards warning



Message: "Illegal Combination of Relay and Interface Cards"

Explanation: For proper communication, matched versions of power trays and interface cards must be installed in a system (i.e., a Version 6 interface card with a Version 6 power tray).

Likely Cause: Someone has probably placed the wrong version of interface card in the computer. Another possibility is that the wrong version has been entered in "Set Parameters". These are far more likely scenarios than the wrong version of power tray, because the power tray has more obvious distinguishing physical characteristics. It is very unlikely that you should ever see this error message.

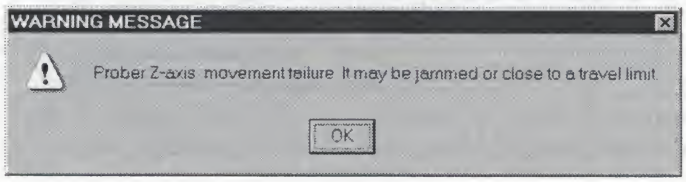
Prober response warning

Message: "The Prober is not responding. Please check if the prober bench hardware and software are powered-up correctly."

Explanation: The Hypervision software and the prober are in communication via a Dynamic Data Exchange (DDE) link. This error message is generated when there is a failure in that communication link.

Likely Cause: The most frequent cause is that the prober is not initialized. The error can also be caused by an incorrect value entered in the "Computer Scope Link" parameter in "Set Parameters". If the prober is initialized and the correct computer scope link value is entered, the error may stem from an actual hardware failure in the prober (such as a defective optical encoder), or defective prober controller, or disabled com port on the computer.

Prober movement warnings



Message: "Prober X/Y/Z-axis movement failure. It may be jammed or close to a travel limit."

Explanation: Generally, the probers have a maximum travel of approximately 2 inches in each axis (X, Y, and Z). During the course of any microscopy session, it is not uncommon for the user to eventually position the microscope near the limit of that travel. It is at that point that this error message is generated. Usually, clicking "OK" will allow you to finish the task at hand.

Likely Cause: The most frequent cause is as detailed above. The error message most usually comes from asking the microscope to move to a position that is at or near a limit (such as repeated live moves along one axis). This message can also be triggered during a lens change, when "Z Lift" exceeds the amount of travel available along that axis. Most of the time, returning the microscope to its "home" position and then repositioning the DUT so that the area to be viewed is directly under the objective will generally keep the user from approaching the travel limit. If however, there should actually be a jam, it will have to be cleared before continuing.

This page intentionally left blank.

Appendix B: Hardware Diagnostic Procedures

About the Hypervision Hardware Diagnostics Utility Software

The purpose of the Hypervision Hardware Diagnostics utility software is to verify the operation of various components of the Hypervision Emission Microscope. From time to time during routine use of the microscope, error warnings or messages may occur which describe a failure in the normal functioning of the system. These error messages tend to be very general in their discussion of the failure. The Hypervision Hardware Diagnostics utility software allows the operator and/or maintenance personnel to further analyze the problem.

NOTE: *The Hypervison Diagnostics utility software does not provide controls for the emission camera.*

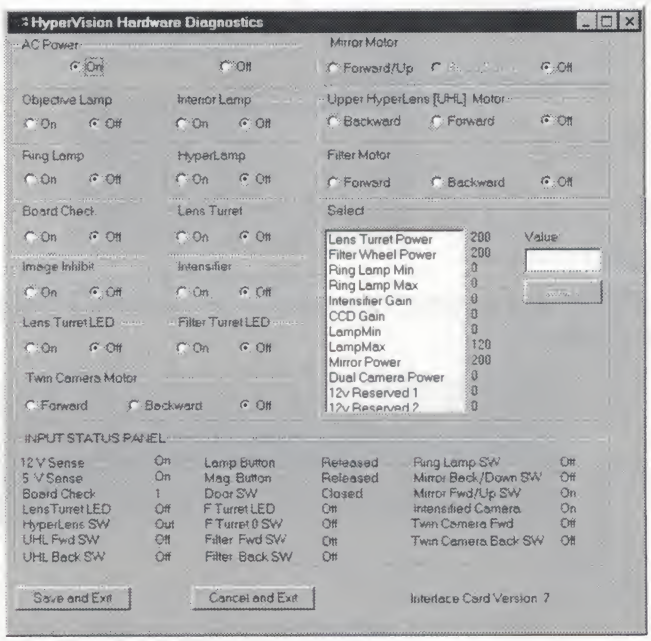
Using the Hypervision Hardware Diagnostics Utility Software

To use the Hypervision Hardware Diagnostics utility software:

1 Exit the BEAMS System Software. The Hypervision Hardware Diagnostics utility software cannot run while the BEAMS System Software is operating.

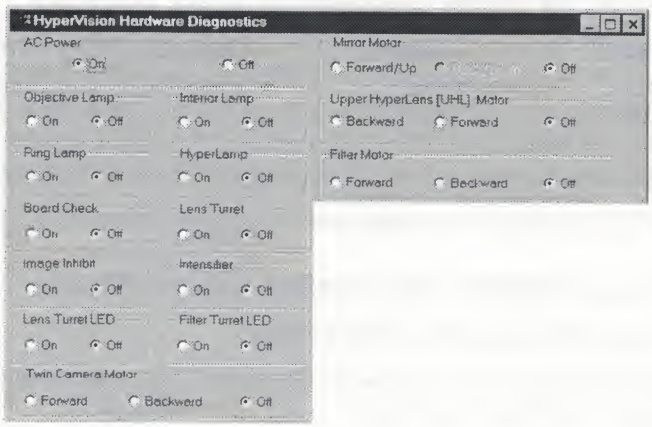
2 Double-click the Diagnostics icon.

3 The Hypervision Hardware Diagnostics dialog opens.

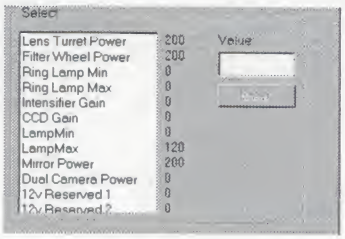


The Hypervision Hardware Diagnostics dialog contains three functional panels:

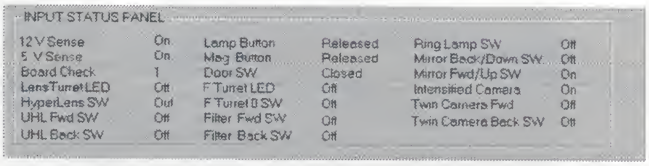
- The Control panel provides on/off power switches and motor controls.



- The Variables panel allows the user to change the output of the Digital to Analog Converter on the Hypervision interface card. These output levels are set by "BEAMS Configuration" when the BEAMS software is operating.



- The Input Status panel provides information on the status of sensors, LEDs, switches, and other Hypervison hardware.



4 In the Control panel, click the AC Power On button.

5 In the Input Status panel, confirm that the 12V Sense and the 5V Sense indicators read On. If either indicator displays a question mark, confirm the following:

- The input power cord to the power tray is connected.
- The main power input switch on the front of the power tray is set to On.
- The appropriate circuit breakers on the rear panel of the power tray are set to On. Reset if necessary.

If the power tray still does not energize, contact Hypervision for service or for a replacement.

6 Open the enclosure doors to allow observation of selected functions.

7 When you have completed your diagnostic procedures, click the AC Power Off button and exit the Hypervision Hardware Diagnostics utility software.

For additional assistance, contact Hypervision Customer Service at (510) 651-7768.

Specific diagnostic procedures

Turret

1 In the Control panel, click the Lens Turret On button.

2 Confirm that the turret is rotating.

3 In the Input Status panel, confirm that the Lens Turret LED indicator toggles from Off to On as each lens rotates into position under the main camera.

4 In the Control panel, click the Lens Turret LED On button.

5 Confirm that the turret stops turning. This verifies that the Opto-LED is functional.

6 In the Control panel, click both the Lens Turret and Lens Turret LED Off buttons.

Analysis: If the turret did not rotate, or if the Lens Turret LED indicator did not toggle from Off to On as each lens rotates into position under the main camera:

- Verify that the lens is not hitting something and preventing rotation.
- Verify that the turret power cable is connected properly.
- Verify proper connection of power tray control cable.
- Check the +5V power supply circuit breaker on the power tray, or replace the power tray.
- Replace the Hypervision interface card inside the computer.

Filter shuttle

For systems equipped with the standard two-position filter shuttle:

1 In the Control panel, click the Filter Motor Forward button.

2 Confirm that the filter shuttle moves to the 1070 nm (Backside) filter position.

NOTE: To physically observe the filter, the camera must be removed from the Optics Tube.

3 In the Input Status panel, confirm that the Filter Fwd SW indicator reads On, and that the Filter Back SW indicator reads Off.

4 In the Control panel, click the Filter Motor Off button.

5 In the Control panel, click the Filter Motor Backward button.

6 Confirm that the filter shuttle moves to the clear filter position.

7 In the Input Status panel, confirm that the Filter Fwd SW indicator reads Off, and that the Filter Back SW indicator reads On.

8 In the Control panel, click the Filter Motor Off button.

Analysis: If the Filter Shuttle did not move when commanded:

- Make sure that the Filter Shuttle cable is correctly connected to the filter assembly.
- Make sure that the filter shuttle is not jammed, for example, by the filter being tilted.

If either of the Filter Fwd SW or Filter Back SW indicators did not read correctly:

- Check the two limit switches in the shuttle housing and their associated wiring.

Filter wheel

For systems equipped with the optional ten-position filter wheel:

1 In the Control panel, click the Filter Motor Forward button.

2 Confirm that the filter rotates in a clockwise direction.

3 In the Input Status panel, confirm that the Filter Turret LED toggles from Off to On as the filter wheel rotates each filter slot into position.

4 In the Control panel, click the Filter Motor On button.

5 Confirm that filter wheel stops turning.

6 In the Control panel, click the Filter Turret LED Off button.

7 In the Control panel, click the Filter Motor Off button.

8 In the Control panel, click the Filter Motor Backward button.

9 Confirm that the filter wheel rotates in a counter-clockwise direction.

10 In the Control panel, click the Filter Motor Off button.

Analysis: Operation of the filter wheel is similar to the turret. Refer to the above analysis under Turret.

Upper Hyperlens (UHL) motor

1 In the Input Status panel, check the UHL Fwd SW and the UHL Back SW indicators readings.

NOTE: Either of the UHL Fwd SW or UHL Back SW indicators can read On, and both indicators can simultaneously read Off, but both indicators cannot simultaneously read On.

- If the UHL Fwd SW indicator reads On, click the Upper Hyperlens (UHL) Motor Backward button in the Control panel.
- If the UHL Back SW indicator reads On, click the Upper Hyperlens (UHL) Motor Forward button.

2 Listen for the sound of the HyperLens motor to confirm that it is in operation.

3 Confirm that the appropriate UHL Fwd SW or UHL Back SW indicator changes from On to Off (depending upon which direction you are commanding the HyperLens motor to travel).

4 After a few seconds, confirm that the other lens switch status indicator changes from Off to On (indicating that the travel limit has been reached).

5 In the Control panel, click the Upper Hyperlens (UHL) Motor Forward and Backward buttons in sequence to move the lens from one end of its travel to the other and back.

6 Confirm that the UHL Fwd SW and UHL Back SW indicators appropriately change between Off to On, reflecting the direction of the lens movement.

7 When you are finished with this procedure, leave the lens in the backward position, and click the Upper HyperLens [UHL] Motor Off button.

Analysis: If the lens did not move, or if the UHL Fwd SW or UHL Back SW indicators did not change from Off to On:

- Verify that the optics cable is securely connected at the optics tube and at the power tray.
- Inspect for a broken limit switch or associated wire inside the optics tube.
- Replace the power tray.
- Replace the Hypervision interface card in the computer.

Mirror

The Mirror functions in much the same way as the Upper HyperLens (UHL) Motor commands.

1 In the Input Status panel, check the Mirror Back/Down SW and the Mirror Fwd/Up SW indicators readings.

NOTE: Either of the Mirror Back/Down SW or Mirror Fwd/Up SW indicators can read On, and both indicators can simultaneously read Off, but both indicators cannot simultaneously read On.

- If the Mirror Back/Down SW indicator reads On, click the Mirror Motor Forward button in the Control panel.
- If the Mirror Fwd/Up SW indicator reads On, click the Mirror Motor Backward button.

2 Listen for the sound of the mirror motor to confirm that it is in operation.

3 Confirm that the appropriate Mirror Back/Down SW or Mirror Fwd/Up SW indicator changes from On to Off, and that the opposing indicator changes from Off to On after a few seconds (depending upon which direction you are commanding the mirror motor to travel).

4 In the Control panel, click the Mirror Motor Forward and Backward buttons in sequence to move the mirror back and forth, confirming that the status indicators change appropriately.

5 When you are finished with this procedure, click the Mirror Motor Off button.

Analysis: If the mirror did not move, or if the Mirror Back/Down SW or Mirror Fwd/Up SW indicators did not switch from On to Off, or Off to On as the mirror travel limits were reached:

- Verify that the optics cable is securely connected at the optics tube and at the power tray.
- Inspect for a broken limit switch or associated wire inside the optics tube.
- Replace the power tray.
- Replace the Hypervision interface card in the computer.

Lamps

To check the status of the Objective Lamp, the (optional) Ring Lamp, the Interior Lamp, and the HyperLamp:

1 In the Control panel, click the Objective Lamp On button to illuminate the halogen bulb in the black housing located on the end of the illuminator tube.

- Vary the lamp's brightness by adjusting the hardware Brightness control.

2 In the Control panel, click the Ring Lamp On button to illuminate the lights in the inner circumference of the Microtip Ring Illuminator Assembly (if the optional Ring Lamp is attached).

- Vary the lamp's brightness by adjusting the hardware Brightness control.

3 In the Control panel, click the Interior Lamp On button to illuminate the interior enclosure lights.

- Vary the lamp's brightness by adjusting the hardware Brightness control.

4 In the Control panel, click the HyperLamp On button to illuminate the HyperLamp bulb.

- Vary the lamp's brightness by adjusting the hardware Brightness control.

5 When you are finished with this procedure, click the Off button for all lamps.

Analysis: Should any of the lamps fail to illuminate:

- Check for power at the appropriate connector on the power tray.
- Replace the defective bulb, using only specified bulbs to replace failed units.

If none of the lamps would illuminate:

- Reset the Programmable Power Supply (PPS) by cycling (turning off/on) the PPS On/Off rocker switch located on the back panel of the power tray.

This page intentionally left blank.